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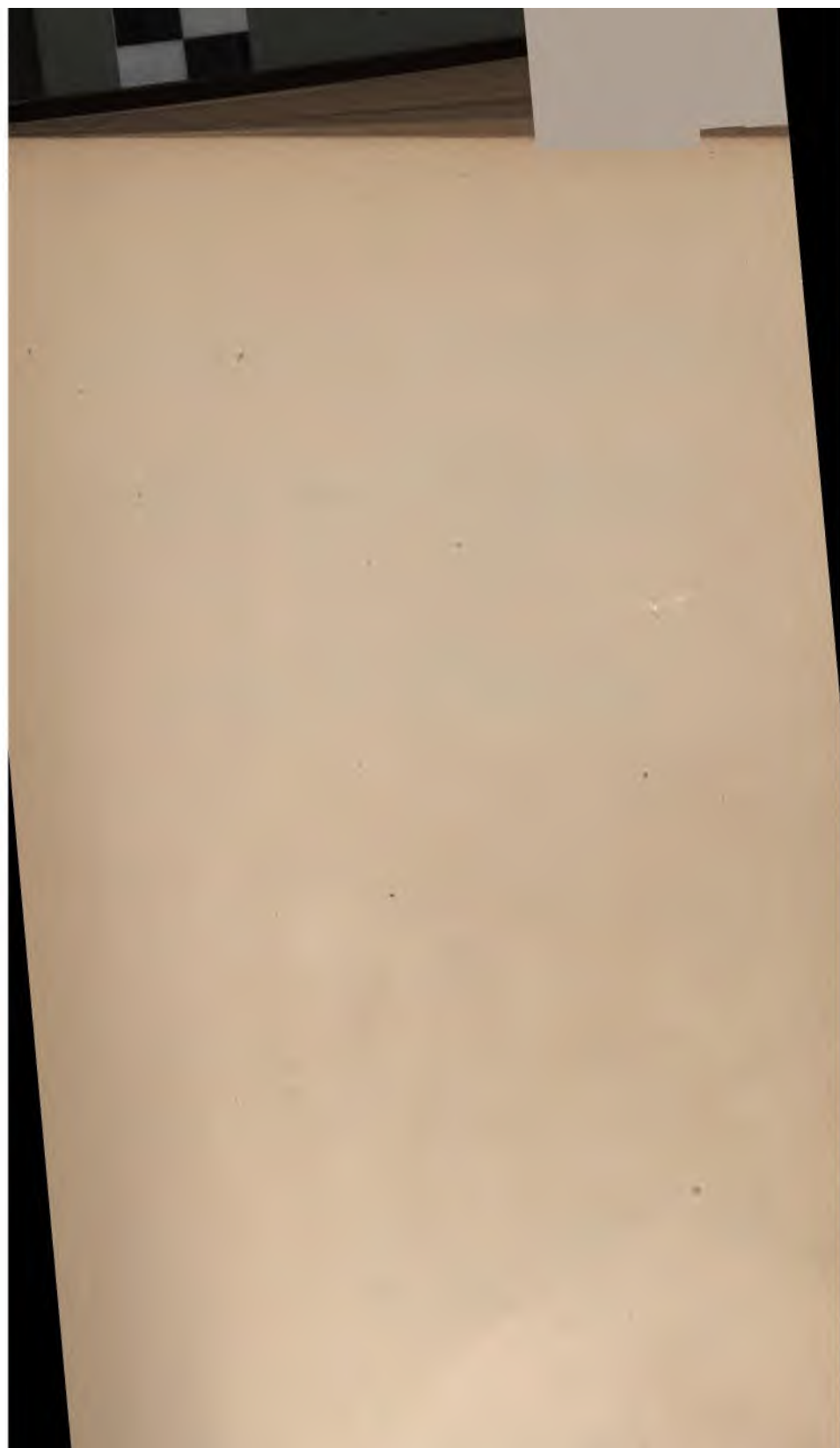
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ILLUSTRATIONS OF DISSECTIONS

IN A

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THE SIZE OF LIFE

REPRESENTING THE
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DISSECTION OF THE HUMAN BODY

BY

GEORGE VINER ELLIS

PROFESSOR OF ANATOMY IN UNIVERSITY COLLEGE, LONDON

AND

G. H. FORD, Esq.

THE DRAWINGS ARE FROM NATURE BY MR. FORD, FROM DISSECTIONS
BY PROFESSOR ELLIS.

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ILLUSTRATIONS OF DISSECTIONS.

ILLUSTRATIONS OF THE PERINÆUM.

DESCRIPTION OF PLATE XXIX.

THIS Figure illustrates the dissection of the posterior part of the perineum.

Boundaries of the perinæum.—The perinæal space corresponds with the outlet of the pelvis. It is limited in front by the symphysis pubis, behind by the tip of the coccyx with the great gluteal muscles, and on each side by the pubic arch, and by the great sacro-sciatic ligament covered by the gluteus.

Depth.—The perinæum reaches into the pelvis as far as the recto-vesical fascia, which forms the partition between the perinæum and the pelvic cavity (Plate xxxix.), and as this septal piece of fascia is directed obliquely downwards and inwards, the measurements to it from the surface of the body will vary at different spots. In front, near the pubes, the depth of the space is about an inch, but it amounts behind to three inches by the side of the rectum.

Division into two.—In this region, as above defined, are contained in the male the excretory tubes for the feces and urine. A transverse line half an inch in front of the anus divides it into two, viz., a posterior or rectal, and an anterior or urethral part.

POSTERIOR PART OF THE PERINÆUM.

In the hinder part of the perinæum lies the rectum, but as the gut does not occupy all the space between the bones, there is a hollow on each side, the ischio-rectal fossa, which is filled with fat, and contains some

vessels and nerves. On the left side, the boundaries of the space may be defined, and on the right, the vessels and nerves may be brought into view, as in the Plate.

To begin the dissection, raise the skin from the posterior part of the space by means of a transverse cut at the front of the anus, and of a longitudinal one carried backwards from the other, around the anus to the coccyx. From the front and back of the sphincter surrounding the anus a fleshy slip is to be followed on each side into the subcutaneous fatty layer.

Next remove the fat and the small vessels and nerves from the ischio-rectal fossa on the left side, and then trace in the right hollow the small vessels and nerves, as in the Figure.

Rectum. About the lower three inches of the large intestine is contained in the perinæum. This part of the gut rests on the end of the sacrum and on the coccyx. Whilst the rectum touches the bones, it is straight in its direction, but at the end of the spinal column it is bent backwards, and ends at the surface in the anal aperture. It is not of uniform size, for at the anus it is narrowed much by the sphincter muscles, but an inch higher it is swollen into a sinus. This dilatation is enveloped by the levator ani muscle, C, on each side.

Commonly, there are rounded swellings of a bluish color projecting from the interior of the gut, which are denominated internal piles or hæmorrhoids; these are formed out of dilated veins in this manner: Within the internal sphincter the middle hæmorrhoidal arteries and veins form loops around the intestine under the mucous membrane, having an arrangement peculiar to this part of the alimentary passage.* From time to time parts of these loops become dilated, and in this state they form small tumors, which are forced down, together with the mucous membrane, through the sphincter by the straining efforts to expel the contents of the rectum, and they carry with them some of the intermingled arterial loops. After a still longer interval, the canal of the vein becomes obliterated by a solidified fibrinous clot, and the submucous areolar tissue outside becoming thickened, the whole forms a firm, dense, fleshy-looking mass. Of course, the number and size of the piles will be proportioned to the enlargement of the veins and the extent to which the

The arrangement of these vessels and their disposition in hæmorrhoids have been delineated in a Work on Diseases of the Rectum, by Richard Quain, F.R.S. Lond., 1854.

loops have descended. If their removal is desired, some means, such as ligature, which would arrest the flow of blood, should be had recourse to, for, as the veins are deprived of valves, the swellings should not be cut off, because the ends of the arterial and venous loops would then remain open to bleed into the intestine.

Muscles of the rectum. Three muscles surround the lower end of the intestine, and are employed in diminishing its opening. A fourth elevates and constricts the gut.

A. Sphincter ani internus.
B. Sphincter ani externus.
C. Corrugator cutis ani.

D. Levator ani.
E. Gluteus maximus.

The *internal sphincter*, A, is a narrow band of pale circular fibres around the extremity of the rectum, which is continuous with the circular fibres of the gut. About a quarter of an inch in width at the surface, it is distinct from the external sphincter, B; and on the intestine it extends ^{down}downwards half an inch, joining the muscular coat of that tube.

This muscle assists in closing the anus, and its action on that aperture is involuntary.

Corrugator cutis ani, C.—Superficial to the internal sphincter is a thin stratum of involuntary muscular fibres to which I have given the above name.* This subcutaneous layer extends around the anus, but only a part on the right side has been delineated. It begins rather external to the preceding sphincter; and the fibres converging enter the anus, and end in the submucous tissue inside the internal sphincter. It forms a thin layer around the anus, which is closely united to the skin.

When the fibres contract they corrugate the skin around the anus, throwing it into lines radiating from the aperture.

The *external sphincter*, B, surrounds the end of the rectum with a thin muscular layer about an inch in width, which is fixed in front and behind. The hinder part is attached by fibrous tissue to the back of the coccyx near the tip, and blends largely with the subcutaneous areolar tissue on each side: in the Figure this part, which is not always very evident, has been cut and reflected. In front, where the muscle is also wide, it is inserted into the central point of the perinæum, and on each side it joins the subcutaneous fatty layer by a rather wide slip.

* This muscle was noticed by me in 1854. I have not found hitherto any reference to it in works of Anatomy. It is constantly present.

This muscle shuts the anus and raises the skin around that opening. Through the close union of this muscle and the corrugator with the dermis, every alteration in the condition of their fibres is accompanied by movement of the skin; and so ulcers near the anus become very painful. Before rest can be obtained and the healing process established, the muscular fibres require oftentimes to be divided. Ordinarily the muscle is kept in a state of contraction through the influence of the spinal cord, and it is relaxed only at the time of passing the feces; but there exists also some voluntary power over the action of the muscle. When the spinal cord is injured this sphincter passes from a tonic state to one of paralysis; and in long-continued exhaustive disease, as fever, it may become powerless, so as to allow of the feces escaping involuntarily.

The *levator ani*, D, forms with the muscle of the opposite side a fleshy diaphragm in the outlet of the pelvis. It is attached above to the inner surface of the os innominatum—partly to bone and partly to the recto-vesical fascia and the triangular ligament (Plate xxxviii.). The fibres descending are inserted into the tip of the coccyx; into the side of the rectum, blending with the sphincter; and before and behind the gut the muscles of opposite sides are joined. The fleshy stratum formed by the two muscles closes the outlet of the pelvis behind the triangular ligament, and is convex downwards: through it the rectum is transmitted. Its under surface looks to the ischio-rectal fossa, and the upper touches the recto-vesical fascia. The origin of the muscle is best seen in the Plate of the side view of the pelvis above referred to.

The chief action of the muscle is to raise and restore to its place the lower end of the rectum after this has been protruded in defecation. It supports also the pelvic viscera, and raises and compresses the tube of the urethra by its anterior fibres.

Ischio-rectal fossa. This hollow is so called from its position between the hip-bone and the rectum. Its extent on the surface of the body is marked by a line opposite the tip of the coccyx in one direction, and the fore part of the anus in the other. After dissection it appears as a somewhat conical interval, which is wide behind and narrow before, and decreases in breadth as it sinks into the pelvis. From before back it measures about two inches. Along the side of the pelvis its depth reaches two inches. Across it is about an inch wide under the integuments.

Its outer boundary is vertical, and consists of the pelvis with the internal obturator muscle covered by fascia. The inner wall, very oblique,

is formed by the levator ani, D, and the external sphincter, B; this surface is covered by a thin fascia. In front is the triangular ligament of the perinæum. Behind lies the gluteus maximus, E; and deeper still is the sacro-sciatic ligament.

Vessels and nerves pass through the space. On the outer wall lies the internal pudic artery, *a*: it is contained in a sheath of fascia, which keeps it in place; and it is accompanied by two veins and the pudic nerve. Posteriorly the vessel is placed about one inch and a half from the surface of the pubic arch, but towards the front of the fossa only half an inch from the edge of the bone. Crossing the space (left side) from the pudic trunks are the inferior hæmorrhoidal vessels, *b*, and the inferior hæmorrhoidal nerve, 3, which distribute branches to the lower end of the gut. At the front of the hollow, close to the outer wall, lie the two superficial perinæal nerves, 1 and 2, with the superficial perinæal artery sometimes: these pass forwards to the anterior half of the perinæum. Behind, near the coccyx, another small nerve, 5, may be recognized: this is an offset from the fourth sacral to the extremity of the rectum and the teguments. Winding round the border of the gluteus maximus at the back of the space, are superficial branches of the sciatic vessels and nerve.

A granular fat fills the hollow and supports the gut. Its deficiency in emaciated bodies causes a surface-depression on the side of the anus. Abscesses are prone to form in it, which manifest a striking tendency to leave sinuses or fistulæ behind them. The different conditions of these sinuses have received special names. If a sinus opens into the lower part of the gut as well as on the skin, having thus an inner and an outer orifice, it is said to be a complete fistula. Supposing the abscess to discharge its contents on the surface of the body in the usual way, the sinus remaining is named an incomplete external fistula; and if it bursts into the gut through the inner boundary of the ischio-rectal fossa without opening externally, the passage remaining is called a blind internal fistula. When abscesses enter the gut they pierce the levator ani and the intestinal wall, and usually at a spot about an inch from the anus. These burrowing passages need to be laid open before they will head, like sinuses in the groin; and in slitting with a knife those that pierce the gut, the levator ani, the external sphincter, and the intestine, will have to be divided.*

* Mr. Marshall has proposed that these sinuses should be cauterized by a wire heated by galvanism, with the view of preventing secondary hæmorrhage. See a paper in Vol. xxxiv. of the Transactions of the Roy. Med. Chir. Society.

Bloodvessels of the posterior part of the perinæum. The small arteries and veins supplying the lower end of the rectum, are derived from the pudic. Some others are distributed to the integuments by the sciatic vessels.

- | | |
|---|---|
| <p>a. Pudic artery.
b. Inferior hæmorrhoidal.</p> | <p>c. A second hæmorrhoidal branch.
d. Branches of the sciatic.</p> |
|---|---|

The *pudic artery*, *a*, an offset of the internal iliac in the pelvis, enters the perinæum through the small sacro-sciatic notch, and ascends through this region to end in the penis or the clitoris, according to the sex. In the hinder part of its course the vessel lies in the ischio-rectal fossa, and gradually becomes more superficial in front, as before said. It is accompanied by two veins, by the trunk of the pudic nerve which is deeper than it, and by the perinæal branch of the same nerve which is nearer the surface: the anterior part of the vessel appears in Plate fxxi. In this part of its course it gives the following branch to the rectum.

The *inferior hæmorrhoidal artery*, *b*, crosses the centre of the ischio-rectal fossa, and divides near the gut into branches for the supply of the muscles, the integuments, and the fat. One or two of its offsets run forwards to the teguments in front of the ischio-rectal fossa. The artery may be represented by two pieces, as in the Plate.

Pudic veins. Two veins accompany the pudic artery, and they receive from the ischio-rectal fossa small veins, which are companion branches of the hæmorrhoidal artery.

Sciatic artery. Branches, *d*, of this artery come to the surface round the gluteus: most of them end in the integuments, but some enter the muscular fibres. Veins run with the arteries.

Nerves in the posterior part of the perinæum. Nerves from three sources, viz., the sacral, pudic, and small sciatic, are met with in the ischio-rectal fossa.

- | | |
|---|--|
| <p>1. Anterior superficial perinæal.
2. Posterior superficial perinæal.
3. Inferior hæmorrhoidal.</p> | <p>4. Branches of the small sciatic.
5. Branch of the fourth sacral.
6. Branches of the lower sacral nerves.</p> |
|---|--|

The *pudic nerve* is a branch of the sacral plexus, and accompanies the artery of the same name, distributing offsets like it for the most part. In the posterior half of the perinæum the nerve lies deeper than the artery (Plate xxxi.), and furnishes the two following branches:—

The *inferior hæmorrhoidal*, 3, runs with the artery of the same name across the ischio-rectal fossa, and ends in the external sphincter muscle and the integuments: some offsets are directed forwards to the fore part of the perinæum.

The *perinæal branch* of the pudic, of larger size than the piece of the trunk continued to the penis, furnishes all the remaining nerves of the perinæum. It begins about half way along the fossa, and becoming superficial to the artery splits into cutaneous, muscular, and genital offsets:—

Only the two cutaneous offsets are now dissected in part: they are named superficial, perinæal, anterior, 1, and posterior, 2, and are contained for a short space in the ischio-rectal fossa, as they course forwards to end in the scrotum:

Sacral nerves. A branch of the fourth sacral nerve, 5, pierces the fibres of the levator ani near the tip of the coccyx, and is distributed to the external sphincter and the integuments.

Altogether behind the ischio-rectal fossa one or two other small branches of the sacral nerves will appear (according to the extent of the dissection) by the side of the coccyx: they pierce the fibres of the *gluteus maximus*, and ramify in the integuments.

Small sciatic nerve. Cutaneous branches, 4, of this nerve wind round the largest gluteal muscle to reach the integuments near the sacrum and coccyx.

In the posterior half of the perinæum the first incisions in the lateral operation of lithotomy are begun. With the view of opening a way down to the urethra, and of securing an aperture in the integuments large enough for the free use of the forceps and the extraction of the stone, the operator sinks his knife through the skin just in front of the anus, and carries it downwards and backwards as far as midway between the anus and the ischial tuberosity. In this first stage of the operation the knife should be kept in the middle of the ischio-rectal fossa, and should be made to penetrate more deeply behind than in front. Necessarily the hæmorrhoidal vessels and nerves crossing the fossa must be cut as the hollow is laid open. If the incision in the skin is too near the anus the rectum may be cut, and if it is taken close to the bone externally the pudic artery may be injured. In the usual adult state of the parts the pudic vessels cannot well be reached; but in a child in whom the bones

are undeveloped, or in a man with a very narrow pelvic outlet, the artery might be wounded at the fore part of the fossa, where it becomes much more superficial. The rectum will usually remain untouched in the living body, supposing it to have been previously freed from its contents, by pressing it inwards away from the scalpel with the fore finger of the left hand.

Within a distance of three inches from the anus the gut may be cut, where disease renders an operation necessary, without fear of passing the limits of the perinæum, and entering the cavity of the pelvis. Should the lower end of the rectum be removed the sphincters and levator ani would be destroyed, and an inability to control the passing of the feces would necessarily follow such an operation.

DESCRIPTION OF PLATE XXX.

THE superficial fascia, with muscles, vessels, and nerves of the anterior half of the perinæum, are delineated in this Figure.

Supposing this dissection follows that in Plate xxix., it may be executed by raising laterally the skin by means of a central longitudinal incision from the scrotum to a transverse cut in front of the anus. For the reflection of the subcutaneous fatty layer air should be blown beneath it, on each side, by means of a blow-pipe inserted through it at the fore part of the ischio-rectal fossa; and then an incision should be made through the fat along the track of the air.

On the left side throw outwards the fatty layer to show its hinder and lateral attachments, and a membraniform layer on the under surface; but the part extending on to the thigh may be taken away down to the fascia lata, as in the Drawing. On the right side the superficial perinæal vessels and nerves are to be traced out as the superficial fascia is reflected.

When the fatty layer has been examined it may be partly removed on both sides for the display of the muscles.

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ANTERIOR PART OF THE PERINÆUM.

This part of the perinæal space is placed anterior to a line half an inch in front of the anus. It lodges the tube of the urethra, and the roots of the penis with their appertaining muscles, vessels, and nerves. Commonly its form is an equilateral triangle, and its sides measures three inches. Its boundaries have been detailed (p. 9). All the parts included in this space are covered by the subcutaneous fatty layer described below.

The *superficial fascia*, G, clothes the body under the skin, and is directly continuous with the same layer in the scrotum and on the thighs; but as it is continued into the scrotum it loses its fat, and acquires involuntary muscular fibres, forming therewith a contractile tissue (dartos).

Over the fore part of the perinæal space the fascia possesses a membranous layer on the under surface, which is indicated in the Plate, and has the following connections:—Externally it is fixed into the margin of the hip-bone outside the crus penis. Behind, it bends down at the back of the transversalis muscle, to be united with the triangular ligament of the urethra. And in front it is continued into the scrotum without being connected with any subjacent part. Attached thus on the sides and behind, it arches over the space containing the urethral tube and the muscles. From its under surface some areolar tissue projects downwards opposite the urethra, and forms a partition between the right and the left side: this is a complete septum behind, but is incomplete in the scrotum where it is pervious to air or fluid.

The space thus included by the attachments of the superficial fascia opens into the scrotum in front, and is partly subdivided behind. When air is blown under the fascia it passes forwards on the same side as far as the median septum is complete, and it then diffuses itself in the scrotum; but if more air is still forced in on the same side it will move backwards from the scrotum along the opposite side of the perinæum. When urine finds its way into the fore part of the perinæum through an aperture in the urethra it is directed forwards through the scrotum, like the air, by the attachments of the superficial fascia on the sides and behind.

Tube of the urethra. In the side view of the male pelvis (Plate XL.)

the transversalis muscle, and through the levator ani at the fore and inner part of the ischio-rectal fossa.

Superficial perinæal vessels. The arteries which are distributed to the superficial muscles and the integuments are derived from the pudic trunk. Veins accompany the arteries, and end in the pudic.

a. Superficial perinæal artery.

b. Transverse perinæal artery.

c. Cutaneous offsets of the superficial perinæal to the thigh.

The *superficial perinæal* artery, *a*, arises from the pudic trunk near the front of the ischio-rectal fossa, and crosses over the transversalis muscle as it courses forwards to end in the scrotum; at the fore part of the perinæum it divides into pieces, and it is sometimes split into two from the origin. It furnishes offsets to the superficial perinæal muscles, to the integuments of the thigh, and sometimes the following branch.

The *transverse perinæal* artery, *b*, comes either from the preceding or from the pudic trunk near it, and passes inwards behind the transversalis to end in the integuments, and in the muscles between the rectum and the urethra.

The *veins* with the superficial perinæal artery are large and plexiform at the scrotum.

Superficial perinæal nerves. Three nerves supply the integuments and the muscles; and these are offsets of the pudic and small sciatic.

1. Inferior hæmorrhoidal nerve.

2. Posterior of the two superficial perinæal.

3. Anterior of the two superficial perinæal.

4. Inferior pudendal nerve.

Two *superficial perinæal* nerves come from the large perinæal branch of the pudic in the ischio-rectal fossa (p. 14), and run forwards with the vessels to the scrotum, in which they ramify. At the scrotum they unite together, as well as with the inferior pudendal.

The more posterior branch, 2, which is likewise the most superficial, ends chiefly in the integuments. The anterior nerve, 3, passes generally under the transversalis muscle, and supplies the levator ani and the other superficial muscles as it is directed forwards to the scrotum.

The *inferior pudendal* nerve, 4, is a branch of the small sciatic, and pierces the fascia lata of the thigh near the border of the gluteus maximus. Thence being directed forwards, it pierces the superficial fascia,

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and accompanies the other nerves to the scrotum. Soon after it appears it is joined by the inferior hæmorrhoidal; and nearer the scrotum, by the superficial perinæal branch.

From the superficial position of the spongy part of the urethra, a catheter or sound passing along it can be felt readily throughout; and in a case of difficulty in moving the instrument along, assistance may be given with the finger of the other hand.

Stricture of the urethra is most frequent where the tube is covered by the ejaculator urinæ muscle. In the operation of cutting down upon the stricture from without, the muscle and the spongy wall of the urethra will have to be divided, but there will be little danger of bleeding if the incision lies directly in the middle line, for no vessel of any size will be met with in that position; and if the knife is passed through the median tendinous line between the ejaculator muscles, the only structure to furnish blood is the spongy vascular wall of the urethra.

If openings in the tube of the urethra should occur in consequence of disease or accident the urine may escape from the passage, and become diffused beneath the superficial fascia of the perinæum. After the fluid is extravasated it will be directed forwards to the scrotum, as before said, by reason of the insertion of the superficial fascia into the firm underlying parts (p. 17).

DESCRIPTION OF PLATE XXXI.

This figure is designed to exhibit the triangular ligament of the urethra, and the muscles and vessels inclosed in it.

This third dissection of the perinæum may be made, after the preceding, by taking the ejaculator urinæ from the urethra, and by detaching on the left side the erector penis and the crus penis from the bone. Next a vertical cut on the left side may be carried through the fore part of the triangular ligament, for the lower two thirds of the depth, to show the parts between the layers.

THE URETHRA AND THE TRIANGULAR LIGAMENT.

The tube for the conveyance of the urine curves through the fore part of the perineal space from the bladder to the end of the penis, and pierces the triangular ligament. It is divided into three regional parts, as before said (p. 17). In Plate XL. the form and length of these divisions are better displayed.

The spongy or outer portion, about six inches in length, receives its name from being surrounded by a vascular structure, the corpus spongiosum urethræ. Posteriorly the spongy material swells out into the bulb, C, where the diameter of the canal is also enlarged; and in front it is dilated into the glans penis, with a corresponding dilatation inside. Usually there is a median depression in the bulb, over the position of a partition which divides the corpus spongiosum into a right and a left half. The swelling of the bulb is united to the front of the triangular ligament by fibrous tissue; and it, with about two inches of the urethra, is covered by the voluntary ejaculator urinæ muscle.

The membranous part of the tube, the shortest, is directed upwards and backwards through the layers of the triangular ligament. Its length is three-fourths of an inch. Its distance from the symphysis pubis is an inch, and it lies equidistantly between the hip-bones. Within the layers of the triangular ligament it is surrounded, like the spongy part, with a voluntary muscle, the constrictor urethræ, H.

The prostatic or the innermost portion of the urethra is about one inch and a quarter in length. It is contained altogether in the prostate; and it will have the same connections with surrounding parts as that body.

The *triangular ligament*, K, acts as a supporting structure to the urethra, and fills the fore part of the pubic arch: it closes also the interval between the contiguous borders of the levatores ani. Its widest part is turned backwards; and its length is one inch and a half at the centre from above down.

It is connected with the parts around in the following way:—The apex is united with the symphysis pubis. The base, somewhat arched on each side, joins in the middle line the central point of the perinæum, whilst laterally it is connected with the superficial fascia, and with a fascia cov-

ering the levator ani in the ischio-rectal fossa. On each side the ligament is fixed into the hip-bone.

Two membranous strata enter into the composition of the triangular ligament: they are named anterior and posterior, and are near together above, but are separated below by the urethra and its muscles. Only the anterior layer is visible in the Plate.

The anterior layer, partly cut through on the left side, is a thin fibrous membrane, which permits the subjacent muscular fibres and the vessels to be seen through it. It has several apertures:—Thus perforating the ligament in the middle line, one inch from the pubes and the sides of the pubic arch, is the tube of the urethra; and midway between the former opening and the pubes the dorsal vein of the penis pierces both layers of the ligament. On each side, near the apex, the dorsal artery and nerve of the penis issue through separate holes in the anterior layer.

The posterior layer of the ligament is continuous with the pelvic fascia; and it may be seen in Plate xxxix. of the pelvis.

Between the layers of the ligament on each side the following parts are inclosed. Near the base of the ligament, and directed transversely towards the urethra, are the deep transverse muscle, J, the constrictor urethræ, H; and under these, near the middle line and below the tube of the urethra, lies Cowper's gland. Along the side of the ligament, where it is fixed to the bone, the pudic artery is situate: this sends inwards near the base of the ligament a transverse branch to the bulb. And by the side of the artery, but deeper than it, and contained in a separate tube of fascia, is the pudic nerve.

MUSCLES OF THE MEMBRANOUS PART OF THE URETHRA.

Between the layers of the triangular ligament two muscles are included, viz., deep transverse, and the constrictor urethræ. The other muscles in the Drawing have been already noticed in the description of the two foregoing Plates.

A. Sphincter ani externus.
B. Levator ani.
C. Bulb of the urethra.
D. Ejaculator urinæ, cut.
E. Gluteus maximus.

F. Erector penis.
G. Crus penis, cut.
H. Constrictor urethræ.
J. Deep transverse muscle.
K. Triangular ligament of the urethra.

The *deep transverse* muscle, J, is a narrow fleshy slip which lies along the base of the triangular ligament, nearly beneath the superficial transverse muscle. Externally it arises from the pubic arch; and internally it joins below the urethra the muscle of the opposite side, and is fixed into the central point of the perinæum. This muscle is not always separate from the following.

The muscle acts like the superficial transverse in fixing the central point of the perinæum, and drawing it backwards towards the rectum.

Constrictor urethræ, H. This muscle extends transversely from the pubic arch to the urethra, and unites on that tube with its fellow. The two muscles taken together resemble the sphincter ani externus placed transversely.

It has a tendinous origin from the pubic arch and from the posterior layer of the triangular ligament; and it divides near the urethra into two fleshy strata which pass, one over, and the other under that tube, to join similar parts of the muscle of the opposite side. These fleshy strata reach the whole length of the membranous part of the urethra, surrounding it, and end in a median tendon (more or less complete) both above and below the passage.

When the muscles of both sides act the urethral canal will be diminished like the end of the rectum by the external sphincter. During the act of making water the muscles are relaxed; but they act spasmodically, like the ejaculatores urinæ, in expelling the last portion of that fluid, or the semen. The muscle resembles the ejaculator urinæ in acting only with its fellow.

Orbicularis urethræ.*—Encircling the urethral tube within the fibres of the constrictor is a thin layer of circular involuntary muscular fibres, which is continuous behind with the fibres of the prostate.

PUDIC VESSELS.

The trunks of the pudic artery and nerve are delineated on the left side; and the distribution of the deep muscular branches is shown on the other.

* I have so designated this muscle from its arrangement and action, and have described it in the xxxix. Vol. of the Roy. Med. Chir. Trans. for 1856, p. 327.

- | | |
|--|--|
| <p><i>a.</i> Pudic artery in the ischio-rectal fossa.</p> <p><i>b.</i> Pudic artery in the triangular ligament.</p> <p><i>c.</i> Dorsal artery of the penis.</p> | <p><i>d.</i> Superficial perinæal, cut.</p> <p><i>e.</i> Deep transverse perinæal branch.</p> <p><i>f.</i> Branch to corpus spongiosum urethræ.</p> <p><i>n.</i> Artery of the bulb.</p> |
|--|--|

The *pudic artery*, *a*, courses along the os innominatum, and lies partly in the ischio-rectal fossa, and partly in the triangular ligament. The artery, *b*, between the layers of the ligament is more or less covered by the fibres of the constrictor urethræ, and gives a considerable branch to the bulb of the urethra. Near the pubes it perforates the fore part of the ligament, and becomes the dorsal artery of the penis, *c*.

As soon as the artery appears through the ligament it furnishes a small branch (art. corporis cavernosi) to the crus penis: this has not any letter of reference.

The *branch of the bulb*, *n*, is seen to run transversely through the fibres of the constrictor, and about half an inch from the base of the ligament, to be distributed in the corpus spongiosum urethræ: it supplies an offset to Cowper's gland. Most commonly it is superficial in part to the constrictor muscle.

If this branch springs from the pudic trunk below the level of the ligament it will cross the front of the ischio-rectal fossa to reach its destination, and will be liable to injury in the lateral operation for stone.

Deep muscular branches. These arise by a common offset from the pudic trunk, or from the superficial perinæal artery: they are indicated on the left side.

A deep transverse perinæal branch, *e*, which is sometimes united with the superficial transverse, ends in the fore part of the sphincter and the levator ani. From it an offset is directed through the base of the triangular ligament to supply the constrictor urethræ and the corpus spongiosum urethræ.

Pudic veins. Two veins course with the pudic artery along the side of the perinæal region, and they are joined by veins which accompany the branches of the artery. The companion vein of the dorsal artery of the penis does not join the pudic veins, but enters the pelvis through the triangular ligament, and ends in the vesico-prostatic plexus.

PUDIC NERVE AND ITS DEEP BRANCHES.

The pudic nerve lies in part in the ischio-rectal fossa, and in part in the triangular ligament; and finally perforating the fore layer of the ligament, like the artery, becomes the dorsal nerve of the penis.

In the ischio-rectal fossa the nerve is deeper than the artery: here it furnishes a large perinaeal branch, which passes forwards on the opposite side of the pudic artery, and splits into the two superficial perinaeal nerves before described (p. 20).

Between the layers of the triangular ligament the nerve remains still deeper than the pudic vessels, and lies in a separate sheath of fascia. No offsets are supplied from this last part of the nerve.

The *deep branches* come from the deeper of the two superficial perinaeal nerves:—One, 4, pierces the triangular ligament, and ends in the constrictor urethræ muscle, H; this same branch supplies in this body the erector penis, F. Another branch, 5, enters the corpus spongiosum urethræ.

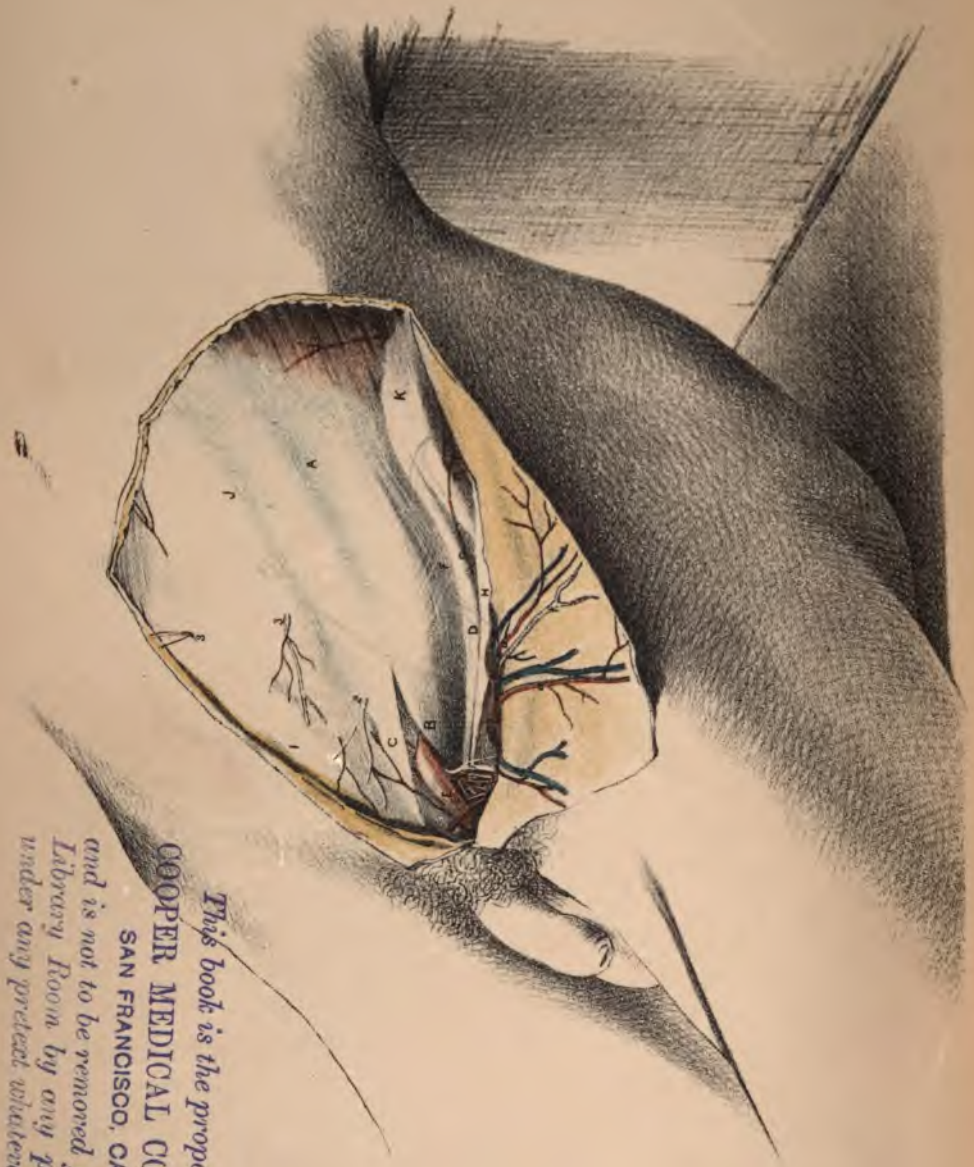
The most direct and the shortest course into the bladder from the perinaeum is through the central point, which is marked thus *; and through it the membranous part of the urethra is entered in both the median, and the bilateral operation for stone.

In the lateral operation for stone the surgeon enters the knife obliquely into the membranous part of the urethra.

In the first stage of the operation the incisions down to the urethra are carried by the side of the rectum and through the ischio-rectal fossa, as before related (p. 15), instead of through the central point of the perinaeum.

The second stage consists in opening the membranous portion of the urethra; and the Drawing shows what parts would be cut through as the knife is placed in the staff. Thus the base of the ligament, the deep transversalis, and the constrictor urethræ muscle, and the deep nerves and vessels (seen on the right side) would be in part divided. The artery of the bulb ought not to be cut, and unless the first incisions are begun too far forwards it will not be injured, when it has its ordinary arrangement; but when it arises behind the triangular ligament, and crosses the





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fore part of the ischio-rectal fossa to reach the bulb, it lies immediately before the scapel, and cannot be avoided by care and knowledge on the part of the surgeon.

In the third stage of the operation the knife is carried through the membranous and prostatic parts of the urethra into the bladder: the direction of the incision, and the parts to be cut through and avoided, will be best understood when the side view of the pelvis is referred to (Plate XL).

In retention of urine from stricture at the back of the spongy portion of the urethra, the distended membranous part of that tube projects towards the surface of the middle of the triangular ligament, near the base, and can be readily reached through the central point of the perinæum.

ILLUSTRATIONS OF THE ABDOMEN.

DESCRIPTION OF PLATE XXXII.

A SURFACE view of the lower part of the tendon of the external oblique muscle, with the superficial fascia, vessels, and nerves of the groin.

The skin being reflected from the groin by a triangular flap, as indicated in the Drawing, the fatty layer containing the vessels comes into sight; and this with its vessels may be thrown towards the thigh, like the skin, after it has been examined. Underneath it appears a thin fibrous layer, H, which may be detached from the aponeurosis of the subjacent muscle as far as the thigh. The tendon of the oblique muscle may then be cleaned with little trouble.

SUPERFICIAL STRATA, VESSELS, AND GLANDS.

Between the skin in the groin and the subjacent muscles two superficial layers are interposed. One is in contact with the cutis, and contains the fat; the other, thin and membranous, rests on the tendon of the external oblique muscle.

The more subcutaneous fatty layer, called the superficial fascia, varies in thickness here as elsewhere with the obesity of the body. In it ramify superficial vessels from the femoral artery, with veins; and as the stratum is separated from the subjacent one by a line of glands at the top of the thigh, it can be easily raised and thrown downwards, as in the Figure.

The deeper stratum, H, thin and translucent, is destitute of fat, and is known as the aponeurosis of the fascia lata (Scarpa), or the deep layer of the superficial fascia. Distinct from the subcutaneous layer at the top of the thigh, glands and vessels intervening, it becomes thinner and less separate as it ascends on the abdomen. When followed down to the limb it will be found to blend with the fascia lata, G, a little below the tendon of the external oblique muscle.

Cutaneous vessels.—In the fatty layer are contained the following small arteries and veins.

- | | |
|---|--|
| <p>a. Superficial epigastric artery.
 b. Superficial pudic artery.
 c. Superficial circumflex iliac artery.</p> | <p>d. Superficial pudic vein.
 e, f. Superficial epigastric veins.</p> |
|---|--|

The three small *arteries* above mentioned ramify in the fat; they are the first branches of the femoral trunk, and communicate with offsets of deeper arteries similarly named. As their names express, the pudic branch, *b*, ends in the pubes and the integuments of the penis; the epigastric, *a*, in the teguments of the lower part of the belly; and the circumflex iliac, *c*, in the fat of the outer portion of the thigh. Many variations occur in their arrangement: in this body the epigastric was divided into branches, and the circumflex iliac was small.

As the superficial pudic crosses the cord it may be cut when the integuments are divided in the operation for inguinal hernia. Usually the vessel is so small as to be disregarded, because the hæmorrhage soon ceases after its section; but if the bleeding is troublesome a ligature ought to be placed on the end nearest the femoral trunk.

Veins. Superficial veins of the same name run with the arteries, and have a like extent. Single or double as they lie with the arteries, they converge below to the internal saphenous vein into which they open.

Inguinal glands.†† Along the line of Poupart's ligament lies a chain of superficial inguinal lymphatic glands, which is marked as above.—They are situate between the subcutaneous fatty layer and the thin aponeurosis of the fascia lata, H, and receive lymphatics from the contiguous parts of

the abdomen and outside of the pelvis, and from the genital organs; and they communicate by deeper lymphatics with glands by the side of the large bloodvessels.—Usually they are about three or four in number, but this varies with their size.

FIRST MUSCULAR LAYER.

The outer muscle of the groin is the external oblique, which receives its name from the direction of the fibres, and the situation in the abdominal wall. Fleishy on the sides, it is tendinous or aponeurotic on the front and below; and near the middle line the aponeurosis blends with the tendon of the muscle beneath.

- | | |
|--|------------------------------------|
| A. Aponeurosis of the external oblique muscle. | F. Intercolumnar fibres. |
| B. External pillar of the abdominal ring. | G. Fascia lata. |
| C. Internal pillar of the abdominal ring. | H. Aponeurosis of the fascia lata. |
| D. Poupart's ligament. | I. Linea alba. |
| E. Spermatic cord. | J. Linea semilunaris. |
| | K. Iliac crest of the hip bone. |
| | †† Inguinal glands. |

The lower part of the aponeurosis has the following attachments. Along the middle line it unites with its fellow in the linea alba, I, reaching to the front of the os pubis. Below, it is fixed at the outer part to the iliac crest, K, and at the inner part to the spine and pectineal line of the pubes by the slip, B: and between these two bony attachments it forms the strong rather rounded band of Poupart's ligament, D, across the thigh.

The aponeurosis is constructed of separate threads directed downwards and inwards obliquely. Near the top of the thigh its fibres are thicker than elsewhere; and a little above and external to the pubes they are separated for a short space, so as to leave an interval—the external abdominal ring. For the purpose of binding together the longitudinal fibres and giving strength to the aponeurosis, a stratum of oblique fibres (intercolumnar) is continued over the surface. Here and there are small apertures in it for the transmission of superficial vessels and nerves.

The named parts of the aponeurosis visible in the Drawing are, the linea alba, linea semilunaris, Poupart's ligament, and the external abdominal ring.

The *linea alba*, I, is a strong tendinous band along the midline of the belly, which reaches from the pelvis to the chest, and in which the aponeuroses of the flat muscles of opposite sides are blended.

Linea semilunaris, J. This is a yellowish line, somewhat depressed even before the integuments are removed, which is directed upwards from the tuberosity of the pubes to the tip of the eighth rib. It marks the position of the outer edge of the rectus muscle, and is rather less strong below.

Poupart's ligament, D, is the thickened lower edge of the aponeurosis across the top of the thigh. Externally it is rounded, and is attached to the front of the iliac crest; internally it becomes widened, and is fixed into the spine and the pectineal line of the hip-bone: and below it blends with the fascia lata, G. This band is curved downwards towards the thigh so as to make the outer third oblique, and the inner two-thirds more horizontal in direction. Like the *linea alba*, it serves as a fixed point for the underlying muscles and the surrounding fascia. It receives also the name crural arch; and in Plate xlv. the reason of this name appears, as the aponeurosis is shown arching over muscles, vessels, and nerves at the top of the thigh.

This firm band can be felt readily through the integument, and marks the limit between the abdomen and the thigh. Even the nature of a hernial tumor may be decided by its position to the band; for if the swelling lies above the ligament it forms an inguinal hernia, and if it projects to the surface below, it constitutes a femoral hernia.

The *external abdominal ring* or the opening in the aponeurosis of the oblique muscle, transmits the testicle in the fetus. Triangular in form, with the apex upwards and outwards, it is placed outside the pubes and extends considerably above that point of bone.—It measures commonly about one inch from base to apex, and half an inch across; but it varies much in size in different bodies, and is smaller in the female than the male. The pieces of the aponeurosis bounding it laterally are named the pillars. The inner pillar, C, flat and thin, is continued to the front of the pubes; and the outer, B, curved around the spermatic cord which rests on it, is fixed to the spine of the pubes, and joins Poupart's ligament below. In this opening lies the cord in the male, and the round or suspensory ligament of the uterus in the female; and through it the inguinal hernia is protruded.

From its margin a thin fascia is prolonged on the spermatic cord or

the round ligament, which is called intercolumnar from its position; and when this covers a hernia it is named the spermatic fascia. In a large hernia this stratum becomes much thickened.

Variations in the size of the opening will affect differently a hernia protruding through it. If the aperture is small its sharp edges will offer some resistance to the return of the gut, and may even constrict the intestinal vessels; whilst if it is larger than usual no impediment will arise from its then comparatively lax margins. After a hernia has existed for a time the opening assumes a rounded form, and from this circumstance the term "ring" has been derived.

The sharpness of the edges and the capacity of the external abdominal ring are modified by the position of the limb to the trunk. When the limb is extended, as in standing, Poupart's ligament is drawn down by the tightened fascia lata of the thigh, and the margins of the opening are rendered tense, whilst the interval between them is diminished. But when the limb is placed in the opposite state, viz., raised and rotated in, Poupart's ligament rises, becoming lax; and the sides of the ring being loose, greater capacity can be more readily imparted to it. In an attempt therefore to push back a hernia the manipulator should see that the hip-joint is bent and rotated in, whilst the body is in a recumbent posture, in order that no impediment shall arise from unrelaxed fasciæ or tendons.

Over this opening the pad of a truss has to be placed in internal or direct hernia; and its position on the surface of the body can be ascertained in this way:—Carry the forefinger along the ridge of the pubic crest from within out, and as soon as it passes the limit of that bony ridge it will be placed over the external abdominal ring.

The *intercolumnar fibres*, F, form a continuous covering upon the aponeurosis of the external oblique. Near the apex of the abdominal ring they are stronger than elsewhere, and to the thickened band in that situation the name "intercolumnar" is given. In this band the fibres form arches with the concavity up, and are prolonged downwards and outwards to Poupart's ligament. By their transverse position they unite together the diverging slender threads of the aponeurosis of the oblique; and passing the pillars of the abdominal ring they give strength to that part so weakened by the existence of a large hole.

The *spermatic cord*, E, reaches from the testicle to the cavity of the abdomen, and passes obliquely through the groin (Plate xxxiv.). It con-

sists of the vessels, nerves, lymphatics, and excretory duct of the testicle, which are surrounded by covering derived from the abdominal wall and the scrotum. As it lies in the external abdominal ring it rests upon the outer pillar, and receives the thin intercolumnar covering from the margin of that opening. A hernia escaping through the external ring will be superficial to the cord, and will descend within the covering derived from the margin.

Cutaneous vessels. Several small arteries with companion veins issue through apertures in the aponeurosis of the external oblique; these are distinct from the cutaneous vessels of the groin before described (p. 28), which belong to the femoral trunks.

Five small arteries appear near the middle line, and are derived from the epigastric in the abdominal wall: another is placed near the iliac crest of the hip-bone, and comes from the circumflex iliac artery.—A branch, larger than the rest, though like them unnamed, issues through the abdominal ring with the cord, and ends in the integuments of the scrotum and upper and inner parts of the thigh. Cutaneous nerves accompany most of the arteries.

Cutaneous nerves. The nerves are more constant than the vessels in their position and distribution, and some of them are named: they perforate the aponeurosis of the external oblique.

- | | | |
|---|--|--|
| 1. Cutaneous part of the ilio-inguinal.
2. Ending of the ilio-hypogastric. | | 3. Cutaneous endings of the dorsal nerves. |
|---|--|--|

The *ilio-inguinal* nerve, 1, is a branch of the lumbar plexus. It courses through the parietes of the abdomen as far as the external abdominal ring, through which it issues to supply the integuments of the scrotum or of the labium, and of the contiguous part of the thigh, like its companion artery.

The *ilio-hypogastric* nerve, 2, arises with the preceding from the lumbar plexus, and passing with it through the wall of the abdomen, ends near the pubes in the integuments of the hypogastric region: further back it gives a cutaneous iliac branch over the crest of the hip-bone.

Dorsal nerves. The lower six of these nerves are partly contained in the wall of the abdomen: they perforate the external oblique tendon, like



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the two preceding, and ramify in the teguments near the middle line of the body. More posteriorly they furnish also lateral cutaneous branches to the side of the abdomen.

DESCRIPTION OF PLATE XXXIII.

THE internal oblique muscle with the cremaster is depicted in this Figure.

This dissection of the second layer of the groin will be completed by cutting through and reflecting the obliquus externus in the manner shown, and by removing from the fibres of the internal oblique the thin inter-muscular layer of areolar tissue.

The nerves and small vessels will be defined as the areolar tissue is cleared away.

SECOND LAYER OF THE GROIN.

Two muscles enter into the second stratum of the groin: of these the chief one is the internal oblique, and to it the cremaster is connected below.

- | | |
|-------------------------------------|-----------------------------|
| A. External oblique muscle. | E. Pyramidalis muscle. |
| B. Tendon of the oblique reflected. | F. Spermatic cord. |
| C. Poupart's ligament. | G. Internal oblique muscle. |
| D. Cremaster muscle. | I. Band behind Poup. lig. |

Internal oblique muscle G. This muscle is distinguished from the preceding by the direction of its fibres; and it arches over the spermatic cord, instead of being pierced by a hole for the same, as the external oblique is. Below it possesses fleshy fibres, where the obliquus externus is tendinous; and these are attached (part of the origin) to the outer half of Poupart's ligament, C, to a fibrous band behind it, I, and to the crest of the hip-bone. From this origin the fibres pass forwards, the upper ascending, and the lower arching over the spermatic cord, to end in the common tendon or aponeurosis.

The aponeurosis of the muscle unites inseparably with that of the ex-

ternal oblique towards the middle line of the body, and ends with it in the linea alba. The part laid bare has the following attachment below:—it is inserted into the front of the pubes, and, farther out, into the pectineal line for half an inch. Above the umbilicus the tendon is split to incase the rectus muscle, but midway between the navel and the pubes it is undivided, and is continued in front of the rectus.

In the groin the muscle covers the aperture in the abdominal wall through which the testicle escapes, and it conceals in part the spermatic cord. Its lower edge is free, and arches over the cord: contiguous to this edge is the cremaster muscle D. Several superficial nerves and vessels pierce the muscle.

The *cremaster* muscle, D, lies along the lower border of the internal oblique, and covers with loops the spermatic cord. Externally the muscle arises by fleshy fibres from Poupart's ligament below the internal oblique and transversalis, some fibres blending with those muscles; and internally it is inserted by tendon into the pubes and the aponeurosis of the internal oblique. It has the following arrangement with respect to the spermatic cord:—On each side it forms a fleshy bundle, the external being the strongest, and over the front of the cord it gives rise to a series of loops which reach to the testicle. Further the fleshy loops are united by areolar tissue so as to produce a continuous layer—the cremasteric covering of the cord: this layer is named the cremasteric fascia when it forms an investment for an inguinal hernia.

By the shortening of its loops this muscle can raise the testicle towards the abdomen: its action is chiefly under the control of the will, but at times is involuntary.

Nerves. Three nerves run forwards in the groin between the external and internal oblique muscles: two are offsets of the lumbar plexus, and the other is derived from the last dorsal (intercostal) nerve.

- | | | |
|----------------------------|--|----------------------------------|
| 1. Ilio-hypogastric nerve. | | 4. Branch to pyramidalis muscle. |
| 2. Ilio-inguinal nerve. | | 5. Offset of a dorsal nerve. |
| 3. Cremasteric branch. | | |

The *ilio-hypogastric* nerve, 1, is derived from the lumbar plexus, and has been traced at its ending in the integuments (Plate xxxii. p. 32). In this Illustration of the dissection of the groin, the nerve is shown piercing the internal oblique muscle, near the iliac crest, and the aponeu-



rosis of the external oblique, near the abdominal ring, in its course to the surface of the abdomen.

The *ilio-inguinal* nerve, 2, is an offset with the preceding from the lumbar plexus. Having, at first, a similar course with its companion, it then passes through the internal oblique somewhat lower, and issues from the wall of the abdomen at the external abdominal ring, to reach the scrotum and the integuments of the top of the thigh. It furnishes an offset, 3, to the cremaster, and another, 4, to the pyramidalis muscle.

Last dorsal nerve, 5, runs forward between the oblique muscles, and perforating the aponeurosis of the external muscle opposite the linea semilunaris, ends in the teguments.

Cutaneous vessels. A few unnamed cutaneous arteries with veins perforate the abdominal muscles: the chief of these are situate near the middle line, and are derived from the epigastric vessels.

DESCRIPTION OF PLATE XXXIV.

A VIEW of the transversalis muscle and fascia, with the spermatic cord, appears in the Plate.

Supposing the internal oblique laid bare as in the preceding Plate, this dissection will be made ready by cutting vertically through the lower three inches of the muscle near Poupart's ligament, and reflecting it inwards. The cremaster may be separated afterwards from the cord.

THIRD STRATUM OF THE GROIN.

All the muscles of the abdominal wall come into sight in this Illustration, the transversalis being the deepest; and under this last muscle lies the fascia transversalis.

- A. External oblique muscle.
- B. Aponeurosis of external, reflected.
- C. Internal oblique muscle.
- D. Internal oblique, reflected.
- E. Cremaster muscle.

- G. Tendon of the transversalis.
- H. Conjoined tendon.
- I. Fascia transversalis.
- J. Infundibuliform fascia.
- K. Spermatic cord.
- L. Internal abdominal ring.

The *transversalis*, F, is the third flat muscle in the wall of the belly; and it takes its name from the direction of its fibres. Like the oblique muscles, it is fleshy externally and tendinous internally. The part of the muscle in the groin arises by fleshy fibres from the outer third of Poupart's ligament and the adjacent fibrous band, and from the iliac crest; the fibres are directed transversely forwards to the aponeurosis, but the lowest are curved above the cord, as this lies in the abdominal wall.

The aponeurosis unites inseparably with that of the internal oblique, and reaches with it the linea alba. Below, it is attached to the front of the pubes like the internal oblique, and to an inch of the ilio-pectineal line beneath the tendon of the internal oblique, some fibres blending with the subjacent fascia. Above the umbilicus the aponeurosis lies beneath the rectus; but about midway between the navel and the pubes it is placed over the muscle.

Conjoined tendon, H. Near the pelvis the aponeuroses of the internal oblique and transversalis are partly united at their insertion into the pectineal line of the pubes, and form the stratum of the conjoined tendon. But the two do not contribute to its formation in equal proportions, for the aponeurosis of the oblique is about half an inch, whilst that of the transversalis is an inch in width.

Fascia transversalis, I. Beneath the transversalis is spread a thin fibrous membrane, which takes its name from being in contact with that muscle. Where the muscle is deficient below the membrane is strongest; and in it is an aperture, L,—the internal abdominal ring, through which comes the spermatic cord. From the margin of the ring a tube of membrane, J, is prolonged around the cord, like a glove on the finger, and is named the funnel-shaped covering of the cord, or the infundibuliform fascia of the inguinal hernia. Outside and below the ring the fascia is thicker and stronger than on the inside where the epigastric vessels appear through it. At Poupart's ligament the fascia descends beneath that band into the thigh, and forms the fore part of the sheath incasing the femoral vessels.

The *internal abdominal ring*, L, is oval in form, measuring most from above down, and is placed about half an inch above Poupart's ligament: on the surface of the abdomen it corresponds with a spot midway between the symphysis pubis and the iliac crest, and a finger's breadth above the ligament of Poupart. It is bounded above by the arched border of the transversalis muscle, F; below by Poupart's ligament; and in-

ternally by the epigastric vessels. In this opening lies the spermatic cord, and through it a piece of intestine is protruded in an external inguinal hernia. The tenseness of the margin of the ring, as well as of the fascia in which it is situate, is determined by the position of the limb; for when the thigh is raised and rotated in, all the strata of the wall of the belly are relaxed, but when the limb is extended, as in standing, those parts are put on the stretch. The influence of the position of the limb on the condition of the opening should be kept in mind when an attempt has to be made to return a hernia into the cavity of the abdomen.

Subperitoneal fat. Underneath the transversalis fascia is a layer of fat, varying in thickness with the obesity or leanness of the body, which gives a covering also to the spermatic cord. On looking into an open abdomen this layer is recognized beneath the peritoneum; and from this circumstance the name has been obtained.

Peritoneum. Still within the subperitoneal fat is the stratum of the serous membrane of the abdomen, or the peritoneum. This is a thin translucent layer, not now visible, from which an offset in the fetus (processus vaginalis peritonei) was continued around the testicle passing from the abdomen to the scrotum: of this prolongation one or two fibrous bands can be usually discovered in the adult, descending in front of the vessels of the cord, and within the tube of the fascia transversalis.

The *spermatic cord*, K, reaches from the testicle to the opening of the fascia transversalis, and consists of the vessels connecting that viscus with parts in the abdomen. In the groin it lies obliquely amongst the abdominal muscles in a channel called the inguinal canal; and it predisposes by its situation to the escape of a piece of intestine from the abdomen. Beyond the abdominal wall it hangs vertically to the testicle, and can be felt on the surface of the body.

Roundish in form and about half an inch in diameter, it is composed of the vessels and the efferent duct of the testicle, with nerves, lymphatics, and areolar tissue. It is surrounded by coverings from the structures amongst or through which it passes, which come in the following order when enumerated from without in:—the integuments, including the skin, and the superficial fascia or the subcutaneous fatty layer; the spermatic fascia (Plate xxxii.); the cremasteric covering (Plate xxxiii.); the funnel-shaped covering (xxxiv.); and beneath all the subperitoneal fat. In the fetus at the time of the passage of the testicle there was an additional partial covering of the peritoneum, but this disappears with the subse-

quent change taking place in the prolongation from that membrane. These several investments will clothe successively a piece of gut protruding along the cord.

Deep vessels of the groin. Vessels from two sources, the epigastric and circumflex iliac, are met with in this dissection.

- a. Epigastric artery and veins.
- b. Branches of circumflex iliac.

- c. Cremasteric branches of the epigastric.

The *epigastric* artery, *a*, is derived from the external iliac, and ascends obliquely upwards and inwards across the groin to enter the sheath of the rectus muscle. The part now seen lies close inside the internal abdominal ring, and beneath the fascia transversalis.

It furnishes small branches internally and externally: two of the outer set marked with, *c*, enter the cremaster, and receive their appellation from that muscle.

The *circumflex iliac* artery arises from the external iliac opposite the epigastric (Plate xxxv.), and runs beneath the transversalis muscle round the iliac crest. Offsets, *b*, are given to the contiguous muscles.

Veins. Two veins belong to each artery, but they blend into one in each case, and end in the external iliac near Poupart's ligament.

ANATOMY OF INGUINAL HERNIA.

A protrusion of intestine through the wall of the belly in the groin constitutes an inguinal hernia. It may escape through the internal abdominal ring with the cord; or it may be placed still more internally—opposite the conjoined tendon, *H*. If the gut descends with the cord it lies outside the epigastric artery, and the hernia is called external inguinal. But if the intestine makes a way for itself opposite the conjoined tendon the tumor forms an internal inguinal hernia in consequence of its position inside the epigastric vessels. The differences between these two kinds of hernia will now be adverted to.

External inguinal hernia is directed downwards by the side of the spermatic cord; and it is called also oblique inguinal hernia from its direction in the abdominal wall.

Inguinal canal. The channel in the groin along which the intestine finds its way is the inguinal canal. This is a narrow passage between the

muscles, which reaches from the internal to the external abdominal ring. Its direction is oblique downwards and inwards; and its length is about one inch and a half. It is constructed by the strata in the wall of the belly in this manner:—Bounding the canal superficially, for its whole length, are the teguments, with the aponeurosis of the external oblique, B; and deeper than the last and at the outer end, is placed the fleshy part of the internal oblique, D, with the cremaster, E, along its border. Separating the passage from the abdominal cavity, comes first the conjoined tendon, H, for a short distance towards the inner end; and behind it, reaching the whole length, lie the fascia transversalis I, the subperitoneal fat, and the peritoneum.

The upper opening of the inguinal canal, by which the gut enters, is the internal abdominal ring (p. 36); and the lower opening, through which the intestine escapes from the wall of the belly, is the external abdominal ring (p. 30).

Coverings.—A piece of intestine coming outwards through the internal abdominal ring, L, receives investments from the surrounding strata. Some of these exist as tubes around the cord ready for the reception of the nascent hernia, whilst others originate during the protrusion of the intestine. As the intestine is forced gradually onwards it elongates and forms for itself coverings of the peritoneum and the subperitoneal fatty layer. And it is then received into the following tubes around the cord, viz., the prolongation of the fascia transversalis (infundibuliform fascia), the fleshy covering of the cremaster muscle (cremasteric fascia), the intercolumnar layer from the external oblique (spermatic fascia), and lastly the subcutaneous fatty layer (superficial fascia), and the skin. The most internal covering of the intestine, the peritoneal or serous, is named the sac of the hernia. If the gut protrudes through the wall of the belly it will be clothed with all seven of the coverings enumerated above, and will form a complete hernia; or if it enters the scrotum it constitutes a scrotal rupture (oscheocele). But if the intestine is stopped in its course in the abdominal wall it gives rise to an incomplete hernia, or a groin tumor (bubonocoele).

Diagnosis.—In distinguishing the external or oblique from the internal hernia the greatest assistance will be derived from the direction and form of the tumor. When it is small, and is still confined to the abdominal parietes, its recognition will be insured by the swelling taking the direction of the inguinal canal, and leading to the internal abdominal

ring where the neck of the tumor sinks into the abdomen; and even an aperture may be recognized with the tip of the finger when the intestine has been pushed back. After the rupture has passed beyond the bounds of the abdominal wall the swelling becomes flask-shaped with the large end towards the scrotum, and with a narrow neck running upwards and outwards in the groin to the position of the internal abdominal ring. With the aid of the fore finger the hernia may be ascertained to lie in front of and rather to the outer side of the spermatic cord; but this diagnostic mark is not so easy to detect as the oblique position in the groin. The diagnosis is not to be made, however, under the following circumstances:—When the hernia is large and of long standing the weight of it draws inwards the movable internal abdominal ring into a line with the external ring, obliterating by that movement the obliquity of the inguinal canal, and causing the external hernia to have a straight course, and the appearance of an internal hernia.

Taxis.—The success of attempts to replace a piece of intestine in the cavity of the abdomen will depend mainly upon the manipulator keeping in remembrance the direction of the inguinal canal, and the influence of the position of the limb upon the tightness of the structures in the groin. Before the taxis is employed the recumbent posture is required, and the thigh is to be raised and rotated in, so that the apertures through which the gut escapes, and all the strata in the groin, may be relaxed as much as possible. To effect the reduction the operator grasps the end of the tumor with one hand, using gradual and uniform pressure over the surface, whilst with the two fore fingers of the other hand he endeavors to direct upwards through the narrowed neck of the tumor in the groin some of the accumulated fluid and gaseous contents of the gut. In this proceeding success will be more likely to attend on the efforts of the person who is mindful of the position of the internal abdominal ring, and of the obliquity of the inguinal canal, than on the attempts of him who may disregard, or may not be acquainted with those facts. Gentle and general pressure continued perseveringly will be always more effective than force applied partially and only for a short time, in evacuating the contents of the intestine, and in returning the gut into the cavity of the belly.

Position of a Truss.—After a hernia has been reduced it must be kept in the abdomen by a truss. In the external inguinal hernia the pad of the truss should close the internal abdominal ring; and it should be ap-

plied to a point in the groin half an inch above Poupart's ligament, and about midway between the pubes and the front of the iliac crest. In the other kind of inguinal hernia (internal) the pad of the truss will occupy a different position (p. 45).

Stricture.—If the intestine cannot be restored to its natural cavity by the taxis, the contents of the alimentary canal accumulate in it; and the veins in the wall of the gut being compressed by the edge of the narrowed hole of one of the abdominal rings (generally the internal) are incapable of returning their contents, so that swelling, and more or less complete stagnation of the flow of blood ensue. In this way the intestine may be strictured or strangulated, according to the degree of completeness of the arrest of the circulation. The constriction may be placed at the internal abdominal ring; at the external ring; or more rarely at the lower edge of the internal oblique muscle. The most usual site of stricture is at the internal abdominal ring, and it may be produced in two ways:—either it results from a constricting band of fibrous tissue outside the peritoneal sac; or from a thickening of the peritoneum itself at the neck of the hernia, so as to form a sharp firm band inside the sac, by which the arrest of the circulation may be brought about when the fæces accumulate in the intestine and increase its size as before explained.

Division of the Stricture.—Division of the band impeding the return of the intestine is to be effected by the operation for hernia. The seat of stricture cannot be ascertained beforehand, but as it is placed most frequently at the internal abdominal ring the incisions are planned with the view of laying bare the neck of the hernia; and as there are two kinds of stricture—one outside, the other inside the sac of the hernia, the mode of proceeding will vary with each. All fibrous bands outside the neck of the sac are first divided in an operation, and an endeavor is to be then made to push back gently the intestine into the abdomen; but if the gut cannot be passed through the narrowed aperture with the employment of moderate force, the peritoneal sac is to be opened below the neck, and the constricting band is to be cut from within out on a director introduced beneath it in a longitudinal direction.

Should the operator ascertain that the stricture is not situate at the internal abdominal ring, he must seek it lower down at the border of the internal oblique, or at the external abdominal ring, as before said. Supposing the constriction to be present at one of those spots, an attempt should be made in the first instance to relieve the intestine

after the manner above explained, and without opening the peritoneal sac.

Varieties of external hernia.—Differences in the state of the peritoneal covering or sac of this hernia give origin to two varieties. Usually these occur in the male infant, and child; but they may be present in the adult male if the peritoneum has the same arrangement as in infancy, in consequence of an arrest in the changes commonly ensuing on the passage of the testicle. One of the two varieties is called congenital and the other infantile hernia.

Congenital inguinal hernia differs from the ordinary external hernia in not protruding as a covering for itself a piece of peritoneum to form the sac. In this kind the intestine descends in the unclosed peritoneal pouch (*processus vaginalis peritonei*) which accompanied the testicle at the time of passage from the abdomen to the scrotum; and consequently it touches the testicle, reaching downwards in front of, and below that viscus.

Its coverings are similar to those of an ordinary external hernia, but its peritoneal covering or the sac is obtained in a different way as just said.

Congenital hernia would be recognized both in the infant and the adult by the extent of the descent of the intestine, for this reaches as far as the lower end of the testicle or beyond it; whilst in the common external hernia the tumor is stopped on a level with the top of the testicle as it extends into the scrotum.

What has been before detailed respecting the taxis and the application of a truss, the seat and the division of the stricture in external inguinal hernia, will apply to this and the following variety of the same kind of rupture.

Infantile hernia is due like the congenital to an unobliterated state of the *processus vaginalis peritonei* of the testicle; and it received its name from being first recognized in children. The state of the peritoneum necessary for the formation of this hernia is the following:—Commonly the vaginal pouch of peritoneum of the testis is obliterated in the fetus from the internal abdominal ring down to the testicle; but sometimes it is obliterated only for a very short distance from that opening, so as to leave a larger sac than usual around the testis, which reaches upwards along the spermatic cord and the inguinal canal. This developmental deviation remains permanently, and will give rise at any period of life to the hernia called infantile.

With the presence of the state of the peritonoum above described, should an external hernia take place, it would push before it in the usual way a sac of the peritoneum with the subperitoneal fat; then it would pass through the internal abdominal ring, and be received into the tubes or coverings incasing the spermatic cord (p. 39). But as it makes its way along the inguinal canal and the cord it comes to be placed behind the loose unclosed pouch of the peritoneum already referred to. In reality there would be two separate serous sacs in connection with this kind of hernia;—an anterior consisting of the tunica vaginalis testis which would contain only serum; and a posterior, the sac of the hernia, opening into the cavity of the belly, in which the intestine is lodged.

Though this rupture may be found in the adult as well as in the child, like the congenital kind, there is not any sign by which it can be distinguished during life from the common external hernia.

Evidence of the existence of an infantile hernia is first obtained in an operation for the relief of the strangulation. Then, as the knife is moved onwards to divide the stricture it opens the loose sac of the tunica vaginalis, in which a serous fluid is generally collected. Should the stricture be placed inside the neck of such a hernia the hinder second sac would have to be cut into before the intestine would be laid bare.

Internal inguinal hernia comes through the abdominal wall at a spot internal to the epigastric artery, and obtains its name from its position inside that vessel. It takes a straight course through the parietes of the abdomen opposite, H; and it is named also direct hernia from its straightness in comparison with an external hernia.

The terms complete and incomplete, bubonocoele and oscheocoele (p. 39), may be applied to this as well as to the external hernia.

Triangular space of the groin.—Inside the epigastric vessels is the triangular space of Hesselbach, in which the internal rupture comes forth. It is bounded externally by the vessels, *a*; internally by the edge of the rectus muscle, *N*; and below by Poupart's ligament. In width it measures about one inch and a half at the base, and from base to apex about two inches.

The following is the arrangement of the strata within the space above defined. Firstly come the teguments, consisting of the skin, and the subcutaneous fatty layer or the superficial fascia. Beneath the teguments the aponeurosis of the external oblique, *B*, covers all the triangular space,

and is pierced by the large external abdominal ring. When this has been reflected the spermatic cord, clothed by the cremaster muscle, E, is seen to lie along the base of the space. Still deeper is the conjoined tendon, H, which is formed by the union of the aponeurosis of the internal oblique, D, and transversalis, F (p. 36): this aponeurotic layer is not wide enough to cover the whole of the space included between the edge of the rectus and the epigastric vessels, therefore there is an interval (about half an inch wide) between its outer border and the epigastric vessels, in which the next stratum appears. Under the muscles the transversalis fascia, I, the subperitoneal fat, and the peritoneum, are stretched continuously over the area of the space, and without apertures in them.

Coverings. The position of the hernia in the triangular interval is determined by the existence of a pit or fossa on the inside of the abdominal wall opposite, H (Plate xxxv.); and it is at this point, behind the conjoined tendon, where the hernia is most commonly found. As the external oblique is the only layer with an aperture in it, and with a tube descending from its margin, all the coverings of the rupture, except that one, will be formed anew, being elongated from the several strata as the intestine gradually makes its way onwards. The intestine in advancing extends firstly the peritoneum and the subperitoneal fat, forming the sac out of the former of the two. Then it pushes forwards the fascia transversalis, and obtains for itself another thin covering. Next, meeting with the obstructing conjoined tendon, it elongates the same; or, if the hernia is produced suddenly, the tendon may be slit to give passage to the tumor. Still advancing, the rupture passes over the cord and the cremaster muscle, and escapes through the external abdominal ring, where it receives the investment of the spermatic fascia. And lastly it comes to be placed under the superficial fascia and the skin, as it descends along the spermatic cord.

Diagnosis. As this hernia enters the wall of the belly nearer the mid line than the internal abdominal ring, and takes withal a straight course, it comes to lie rather inside the spermatic cord as it escapes through the external abdominal ring, and rather over the pubic crest. But the best diagnostic marks between this and an external hernia are, the straightness and shortness of its passage through the abdominal parietes, and the absence from the inguinal canal of a narrowed oblique neck. An internal hernia cannot be distinguished from an external when the last is large, and has been of long standing (p. 40).

Taxis. When the rupture has to be reduced success will be greatly dependent upon a correct diagnosis of its kind, because the spot at which the internal hernia leaves the abdominal cavity is different from that for the external; and attempts to put it back, which would be useful when the kind of hernia is recognized, might be injurious when this has been mistaken. In the case of an internal hernia the passage along which the fæces have to be directed is quite straight through the abdominal wall, and in the direction of a line carried inwards through the external abdominal ring. When the taxis is about to be used, the first requisite is to have the structures in the groin relaxed by placing the trunk in the recumbent posture, and by raising the thigh and rotating it inwards. And during the employment of the taxis the fundus of the tumor should be compressed evenly and steadily with the grasp of the one hand, whilst the fore fingers of the other are used to direct upwards some of the contents of the intestine.

Position of the Truss.—In applying a truss for an internal hernia the pad of the instrument is to be placed on the hole in the aponeurosis of the external oblique muscle, because the aperture of entrance into the wall is opposite the aperture of exit from the same. This opening, or the external abdominal ring, will be opposite a spot on the surface of the body immediately outside the pubic crest.

Seat of Stricture. The band constricting the intestine may be found at two places. Firstly it may exist at the narrowed mouth of the sac, and may be produced by fibrous tissue external to that part, or by a thickening of the wall of the sac inside the neck. Secondly it may result from the firm sharp margin of the external abdominal ring.

Division of the Stricture. Partial or complete arrest of the circulation in the intestine follows inability to reduce the rupture by the taxis; and an operation is needed to set free the gut from its imprisonment; and to arrest its mortification. An incision is to be made through the wall of the belly down to the neck of the tumor, to remove stricture external to the sac; but should this proceeding fail in its object, and the existence of stricture inside the neck of the sac be made thereby probable, the peritoneal covering should be opened, and the constricting band should be divided directly upwards by means of a knife carried along a director inserted under it.

As a large apparently internal hernia, with a straight direction through the abdominal wall, may have begun as an external or oblique one, and

may have assumed afterwards the look of an internal rupture by reason of its weight (p. 40), the scalpel should be kept on the front of the tumor in an operation, and parallel to the middle line of the body. And in dividing the stricture the cut should be made directly upwards in the same direction. By taking these precautions the danger of wounding the epigastric vessels curving around the neck of such a hernia on the inner side will be best avoided.

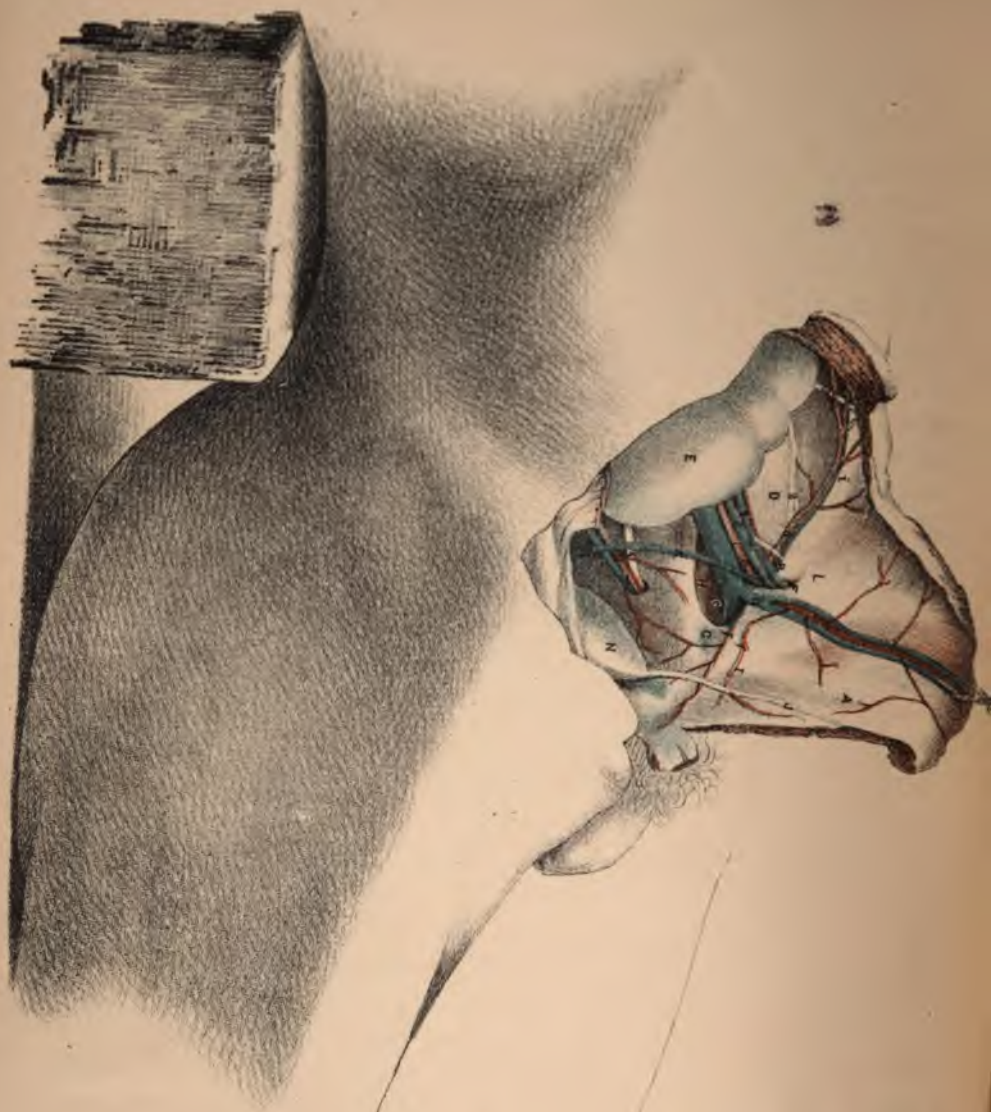
Variety of internal hernia.—Within the triangular space of Hesselbach a rupture may protrude at a different spot from that above mentioned. External in position to the other, it will be placed nearer the epigastric vessels, *a*, coming out between them and the edge of the conjoined tendon, *H*. Without any aperture for its exit, it has to elongate and make coverings for itself, like the common form of internal hernia which lies nearer the pubes.

Course and coverings. The Drawing demonstrates the oblique course the intestine would take through nearly the whole of the inguinal canal. As the rupture is placed farther out in the triangular space than the conjoined tendon it will want necessarily a covering from that stratum; and it differs from the more common internal hernia in not possessing that investment. But as the intestine proceeds along the inguinal canal and the cord it slips within the cremaster muscle, and then issues from the abdominal wall by the external abdominal ring, forming a pear-shaped swelling.

Its coverings from within out will be, peritoneum or sac, subperitoneal fat, fascia transversalis, cremasteric fascia, spermatic fascia, and the teguments and skin: in short, they are the same as to number and structures as the coverings of the external or oblique hernia.

Diagnosis.—During life this kind of the internal hernia is not to be distinguished from the external or oblique in consequence of its traversing so much of the inguinal canal, and having a pear-shaped form like that rupture.

Taxis and the truss.—From an inability to distinguish this tumor from an external hernia, which it would resemble, the same precautions for insuring the return of the intestine by the taxis are to be taken, as were described for that rupture (p. 40). And the pad of the truss, which is to keep the gut in its cavity, should be placed near the situation of the internal abdominal ring, or where an aperture can be recognized by the tip of the fore finger.



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Seat of stricture. The remarks before made on the cause and situation of the stricture of an external hernia will serve for this rarer kind of internal hernia (p. 41).

Division of the stricture. With a suspicion of the existence of the kind of rupture now under consideration care is needful in cutting down to free it from stricture; for the epigastric vessels lie on the outer side, whilst in the external hernia, from which it cannot be distinguished, they are placed on the inner side of the neck of the rupture. In cutting down on the upper part of the hernia to divide the external stricture the scalpel should be kept well on the front and midpart of the tumor, so as to avoid the vessels lying on its side, after the manner recommended in the operation on the large doubtful direct hernia (p. 45); and in dividing the internal stricture of the neck, after opening the sac, the cut should be made directly upwards in front of, and opposite the middle of the hernia. Should these directions be observed there will be little risk of injuring the bloodvessels, even though the diagnosis between the two kinds of hernia cannot be established.

DESCRIPTION OF PLATE XXXV.

INNER view of the groin with the apertures through which the intestine leaves the cavity of the abdomen in hernia.

To prepare the dissection throw down the wall of the abdomen in the left groin in the form of a triangular flap; detach the peritoneum and the subperitoneal fat from that flap, and the colon from the iliac fossa. On the removal of the fat and areolar tissue, and some glands from the side of the large iliac artery and vein, the different smaller vessels and nerves will come into sight.

By separating the peritoneum from the wall of the pelvis the urinary bladder and the obturator vessels appear; but in the dissection here delineated the obliterated hypogastric artery was removed from the bladder.

INNER STRATA OF THE ABDOMINAL WALL.

Inside the muscles of the abdominal wall in the groin are spread some thin membranes, which are connected with hernia, forming coverings for it. In the inner as in the outer view the firm band of Poupart's ligament appears.

A. Rectus abdominis under the fascia.	H. Pectineus muscle covered by fascia lata.
B. Crural arch.	I. Inner inguinal fossa.
C. Gimbernat's ligament.	J. Urachus of the bladder.
D. Iliac fascia.	K. Vas deferens of the testis.
E. Sigmoid flexure of the colon.	L. Fascia transversalis.
F. Internal abdominal ring.	N. Urinary bladder.
G. Crural ring.	

Peritoneum and subperitoneal fat. These two layers have been necessarily detached in the dissection: they cover all the parts now laid bare, separating them from the viscera, and they close the apertures of the internal abdominal and the crural ring.

The *crural arch*, B, or Poupart's ligament (p. 30), stretches across the front of the hip-bone, arching over the muscles, vessels, and nerves, which are continued from the cavity of the abdomen to the thigh. Rounded externally where it is joined to the hip-bone and is united with the subjacent parts, it is separated internally by the iliac vessels from the underlying muscles and bone, and is fixed by a widened part (Gimbernat's ligament) into the tuberosity and the pectineal line of the pubes.

Gimbernat's ligament, C, is that part of the widened inner attachment of the crural arch, which intervenes between the rounded anterior part, B, and the bone beneath. Triangular in shape, the apex is inserted into the tuberosity of the pubes, and the base is turned to the iliac vein, *b*. From apex to base it measures about an inch, and it is kept on the stretch by its union at the base with the fascia lata.

The *fascia transversalis*, L, lines the wall of the abdomen as low as Poupart's ligament. Ceasing opposite that band, it has a different disposition at the outer and inner ends. As far inward as the letter B, it is connected to the ligament, and blends with the iliac fascia, D: between

the spot referred to and Gimbernat's ligament it is continued beneath the inner half of the crural arch, and enters the fore part of the loose crural sheath around the femoral vessel; and still more internally it is fixed into the pectineal line of the pubes beneath the conjoined tendon (p. 36) and Gimbernat's ligament. Just above Gimbernat's ligament is a depression in the fascia, opposite the inner inguinal fossa, I, where the internal inguinal hernia begins to protrude.

Internal abdominal ring, F. This is an elongated aperture in the fascia transversalis, which is external to the epigastric vessels, and little above Poupart's ligament. Through it pass the constituents of the spermatic cord, viz. the spermatic vessels, *c*, and their nerves, the duct of the testis, K, part of the genito-crural nerve, I, and lymphatics: when these have reached the inside of the abdomen they diverge to their destination beneath the peritoneum and the subperitoneal fat. Before the dissection is made the aperture will be closed by the two internal strata of the abdominal wall, viz. subperitoneal fat and peritoneum; but in the state of the parts necessary for the production of a congenital hernia, the ring is not closed by those layers, but remains patent for the escape of the gut; whilst the two strata (peritoneum and subperitoneal fat) form tubes which reach to the testicle and are ready to receive the descending intestine.

In an external inguinal hernia the piece of intestine leaves the abdominal cavity through this hole, and protrudes along the spermatic cord. Of necessity the gut will force onwards, and make coverings for itself of the peritoneum and the subperitoneal fat, as already said (p. 39), before it receives the other coverings from the abdominal wall.

The *fascia iliaca*, D, covers the iliacus muscle, and lies beneath the large external iliac bloodvessels. At Poupart's ligament it joins the fascia transversalis as far inwards as B: but thence to Gimbernat's ligament it is prolonged beneath the iliac artery and vein, and blends with the hinder part of the loose crural sheath on the femoral vessels.

The *crural sheath* (Plate XLIII.) is continuous above with the fasciæ just noticed, the fascia transversalis entering the front, and the fascia iliaca the back of the tube. In it are lodged the great vessels, *a* and *b*, of the limb; and as these occupy only the outer part of the sheath in consequence of the shape of the parts, an interval is left between the iliac vein, *b*, and Gimbernat's ligament, which is named the *crural canal*. The canal gradually tapers from above down, and reaches but a short

distance along the crural sheath: its opening into the abdomen is called the *crural ring*. A femoral hernia passes through this space or passage in the crural sheath.

The *crural ring*, G, is the aperture of entrance into the crural canal from the cavity of the abdomen. About as large as the tip of the fore finger, and flattened like this from before back, it is bounded in front by Poupart's ligament and the subjacent band of the deep crural arch; behind by the pubes covered by the pectineus muscle and fascia lata; internally by the base of Gimbernat's ligament, C; and externally by the iliac vein, *b*. Of these boundaries only the anterior and inner are unyielding and sharp enough to constrict a piece of gut lying in it. If the fore finger is placed in the ring whilst the hip-joint is alternately flexed and extended the influence of the state of the limb on the margins of the ring will be perceived: for laxness of Poupart's and Gimbernat's ligament will be induced by raising the thigh, and tightness of those bands will follow straightening of the limb.

The ring is filled by a lymphatic gland, and transmits lymph-vessels from the thigh to the abdomen. Towards the cavity of the belly it is closed by the strata of the peritoneum and subperitoneal fat. But the subperitoneal layer is thickened over the crural ring, and is projected downwards into that aperture, making thus a partition between the limb and the abdomen; and from this arrangement the term *septum crurale* was applied to it by M. Cloquet.

Vessels occupy the outer side and the front of the ring. In the former situation is the iliac vein, *b*. In the latter lie a small pubic branch, *f*, of the epigastric vessels, and deeper amongst the muscles, the spermatic vessels of the testis. Occasionally the obturator artery, *g*, arises from the epigastric, *c*, above the ring, and descends into the pelvis close to the iliac vein, and along the outer part of the ring. With the same origin it may course to the pelvis along the base of Gimbernat's ligament, at the inner part of the ring: when it thus occupies the inner side, the ring will be encompassed by vessels except at the back.

Obturator or subpubic aperture. Below the brim of the pelvis is a third aperture, which transmits from the abdomen the obturator vessels and nerve. It is a small oblique canal at the upper part of the thyroid foramen; and it is bounded partly by bone, and partly by the obturator membrane and muscles. Like the two apertures before described, it is

separated from the cavity of the abdomen by the peritoneum and the subperitoneal fat.

Occasionally a piece of intestine leaves the abdomen through this hole, forming an obturator hernia. In such a case the tumor would be clothed by the peritoneum and the subperitoneal fat, like the other herniæ, and it would finally escape into the thigh under the pectineus muscle. Very commonly small pellets of fat from the subperitoneal layer project through the aperture.

ANATOMY OF FEMORAL HERNIA.

A protrusion of intestine below Poupart's ligament to the thigh gives rise to a femoral hernia. Part of the anatomy of the hernia can be studied in the abdomen, and part with the lower limb; but only the facts illustrated in this Plate of the dissection of the groin will be here alluded to.

Course. Entering the loose crural sheath through the crural ring, the gut descends on the inner side of the femoral vein along the narrow space of the crural canal, as far as the saphenous opening in the fascia lata; at this spot it escapes from its narrow passage, being directed forwards through the saphenous opening, and forms a swelling on the surface of the thigh. As it proceeds in its course it displaces, or causes to be absorbed the gland situate in the crural canal. Whilst it is in the crural sheath the gut has nearly a straight direction, but as it projects forwards to the surface a bend is formed at the level of the saphenous opening; and as it increases in size, ascending on the abdomen, a second bend is produced. See the description in the thigh. The narrowed part of the tumor beneath Poupart's ligament is named the neck of the hernia.

Coverings. The intestine pushes before it some strata appertaining to the wall of the belly, and others belonging to the thigh. The coverings derived from the abdomen are the peritoneal or the sac, and the subperitoneal or fatty layer which varies much in thickness in different bodies. The limb-coverings are obtained from the crural sheath, and the teguments, and will be described with Plates XLII. and XLIII.

Taxis. By the view in the Plate it appears that the return of the intestine will be retarded by the tendinous band of Poupart's and Gimbernat's ligament, if this is kept tight by an extended state of the thigh; and

therefore the thigh should be raised and rotated inwards to relax to the utmost that band during the employment of the taxis.

Stricture. Strangulation of the intestine takes place most commonly in the neck of the rupture. It may be outside the sac, and be caused by a fibrous band, or by the sharp tendinous edge of Poupart's and Gimbernat's ligament; or it may be placed inside the sac, being produced by thickened peritoneum.

Division of the stricture. When all attempts to relieve the constriction of the gut, by cutting fibrous bands external to the neck of the sac, have failed, the sac will have to be opened, and the knife introduced under Poupart's ligament into the lower part of the belly. In dividing the internal stricture the edge of the knife should be turned inwards because the inner side of the crural ring is usually free from any blood-vessel; but the cutting instrument should not be introduced farther than is necessary, for if the bladder is distended, so as to project above the level of the brim of the pelvis, it may be injured.

Occasionally the obturator artery lies along the inner side of the crural ring (p. 50). When this unusual condition exists the vessel is close inside the neck of the hernia, and would most probably be cut by the knife carried inwards as above directed. Fortunately this exceptional state is very rare in conjunction with a hernia requiring an operation for the relief of strangulation inside the neck of the sac.

EXTERNAL ILIAC VESSELS.

The topographical anatomy of the lower half of the external iliac vessel,—the part of the artery to which a ligature may be applied—is represented in this Illustration.

- | | |
|----------------------------------|---------------------------|
| a. External iliac artery. | g. Obturator artery. |
| b. External iliac vein. | h. Epigastric vein. |
| c. Spermatic artery. | i. Circumflex iliac vein. |
| d. Circumflex iliac artery. | k. Obturator vein. |
| e. Epigastric artery. | l. Spermatic vein. |
| f. Pubic branches of epigastric. | |

The *external iliac*, *a*, is the beginning of the main artery of the lower limb, and is contained in the cavity of the abdomen. It reaches from the base of the sacrum to the lower border of Poupart's ligament, where

it receives the name "femoral." It has a straight course above the brim of the pelvis, and takes the psoas muscle as its guide.

In all its extent the vessel is covered by the peritoneum and the subperitoneal fat; and it is accompanied by a chain of lymphatic glands on the inner side and the fore part. Towards its lower end numerous smaller vessels lie on it; thus the spermatic artery and veins, *c*, and the genital branch, *1*, of the genito-crural nerve pass along it; crossing over its inner side for a short distance is the vas deferens of the testis, *K*; and directed transversely over it near its ending is the circumflex iliac vein, *i*. To its inner side, and taking a deeper position than it, is the external iliac vein, *b*; but on the right side there is a slight difference in the position of the vein (Plate xxxvi.).

Two branches for the wall of the abdomen, viz., circumflex iliac and epigastric, arise from the lower end of the vessel.

Ligature of the artery. The slight depth of the external iliac and the small disturbance of the contents of the abdomen in an attempt to reach it, render practicable the ligature of this vessel by cutting through the wall of the belly in the groin.

Not to displace unnecessarily the peritoneum, the ligature should be kept as near as it can be to Poupart's ligament; but the exact spot to be selected for the application of the thread will be determined by the position of the branches. Usually two branches arise near the end of the artery, and on opposite sides of it; and if the position of these vessels was constant the trunk might be tied about an inch higher up. But as these branches take origin at different distances (one to two inches, Quain) from Poupart's ligament, and as the obturator artery may be attached also to the lower half of the iliac trunk, the spot selected for ligature should be one inch and a half to two inches above the crural arch.

The operation may be practised in this manner. A cut is to be made through the integuments of the wall of the belly in the groin from a point a little above and outside the internal abdominal ring to the front of the iliac crest; but on the right side the cut will be reversed. The three muscular strata are divided successively down to the yellow-looking fascia transversalis, *L*; and then this thin membrane may be slit on a director. Next, the peritoneum and the subperitoneal fat are to be detached carefully with the finger, without rupture, from the iliac fossa. On looking into the wound, with the light falling into it, the artery will be seen in the bottom; and after slightly detaching the iliac trunk from the sur-

rounding parts, a ligature may be readily applied to it. Should the origin of a branch come into sight when the trunk is laid bare it may be included in the thread.

Difficulty in the execution of the operation may be due to enlargement of the contiguous inguinal glands, which may cover the arterial trunk, and would be detached from it with difficulty. The following variation in the situation of the artery will give rise to some embarrassment unless the operator is previously acquainted with it. Not uncommonly the vessel is much bent downwards into the pelvis, so as to lie below the brim, and to be out of sight: in such a condition the artery would have to be raised to its usual level by the fore finger introduced into the wound, before a ligature could be passed around it. Sometimes also in detaching the subperitoneal fat the external iliac is raised from its usual situation, and is carried upwards with that layer: when this displacement occurs the vessel may be detected in the fatty layer by means of the pulsation.

Branches of the iliac. The two branches of the artery ramify in the wall of the belly, one in the front, and the other behind. Only the beginning of those branches can be now seen.

The *epigastric* artery, *e*, ascends on the inner side of the internal abdominal ring to the rectus muscle. At first it lies beneath the fascia transversalis, but finally perforates this membrane to enter the sheath of the rectus. On each side of the artery lies a vein; these join below into one.

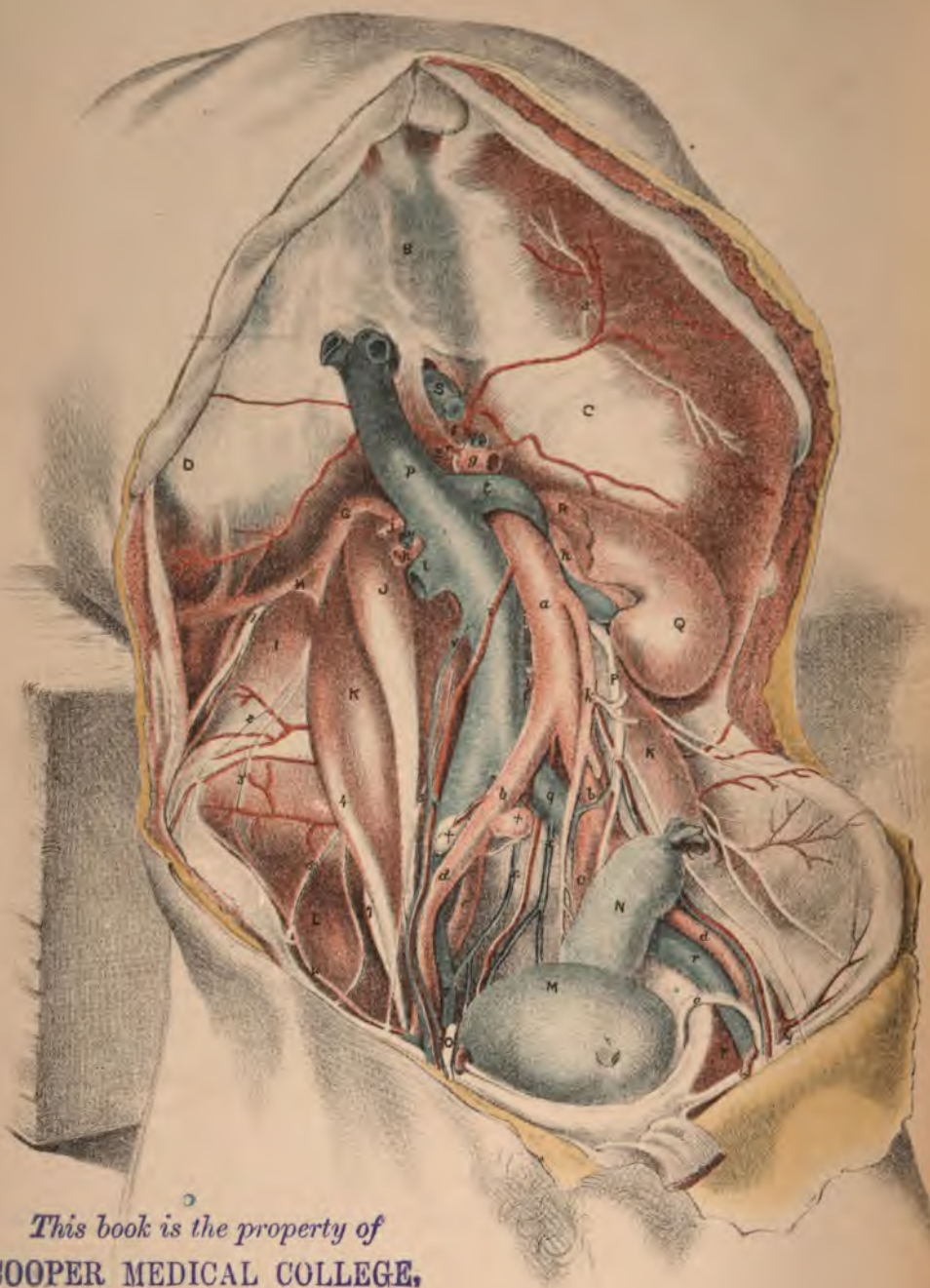
Small branches, *pubic*, run inwards to the back of the pubes, anastomosing with their fellows, and the obturator, *g*. *Cremasteric* offsets (p. 38) are supplied to the muscular covering of the cord.

The *circumflex iliac* artery, *d*, is directed to the iliac fossa below Poupart's ligament (Plate xxxvi.). Small muscular branches are given by it to the abdominal wall and the iliacus.

Two other small arteries, the spermatic and obturator, come into the dissection for a short distance.

The *spermatic* artery, *c*, a branch of the aorta, courses to the testis through the internal abdominal ring. The veins accompanying it unite together higher in the abdomen (Plate xxxvi.).

The *obturator* artery, *g*, arises from the internal iliac trunk in the pelvis, and issues through the subpubic aperture to the thigh. Its companion vein, *k*, and nerve, *4*, have a like course.



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The *nerves* in the dissection are offsets of the lumbar plexus, and are represented more fully in the two following Plates.

- | | |
|-------------------------------------|------------------------------|
| 1. Genital branch of genito-crural. | 3. External cutaneous nerve. |
| 2. Crural branch of genito-crural. | 4. Obturator nerve. |

The *genito-crural* nerve divides into two:—The genital branch, 1, runs on the external iliac artery, and issues through the internal abdominal ring to supply the cremaster muscle; the crural branch, 2, passes beneath Poupart's ligament to the integuments of the thigh.

The *external cutaneous*, 3, is directed under the outer end of Poupart's ligament to the teguments of the thigh.

The obturator nerve, 4, escapes from the abdomen by the subpubic hole with the vessels of the same name, above which it lies: it is distributed in the thigh.

DESCRIPTION OF PLATE XXXVI.

THE deep muscles and the vessels of the abdominal cavity are figured in this Plate.

The objects here represented will be readily cleaned after the removal of the viscera from the cavity of the abdomen; but as the large vein (vena cava) is imbedded in the substance of the liver it is usually cut away in the removal of that viscus. To denude the diaphragm, dissect off with care the peritoneum; to remove that membrane from the tendon of the muscle, to which it adheres closely, will require some skill on the part of the dissector.

On the right side the deep muscles are to be laid bare, but on the left the fascia covering them may remain entire.

The small nerves issuing from the substance of the psoas muscle lie in a loose fat, and can be defined with ease.

MUSCLES IN THE ABDOMINAL CAVITY.

One of the muscles (diaphragm) separates the cavities of the thorax and abdomen, and is used in respiration; the others, placed on the side

of the spine, take part in the movements of the lower limb and the last rib.

- | | |
|-----------------------------------|--------------------------------|
| A. Fleishy part of the diaphragm. | K. Psoas magnus. |
| B. Mid-part of the tendon. | L. Iliacus muscle. |
| C. Left piece of the tendon. | M. Urinary bladder. |
| D. Right piece of the tendon. | N. Rectum. |
| E. Right crus. | O. Vas deferens of the testis. |
| F. Left crus. | P. Left ureter. |
| G. Internal arched ligament. | Q. Left kidney. |
| H. External arched ligament. | R. Supra-renal body. |
| I. Quadratus lumborum. | S. Œsophagus, cut. |
| J. Psoas parvus muscle. | T. Pectineus muscle. |

The *diaphragm*, A, stretches across the hollow included by the ribs, and divides this space into two,—an upper part, cavity of the thorax, and a lower or abdominal cavity. The muscle is fleshy at the circumference where it is fixed to the ribs, and tendinous in the centre.

The diaphragm takes origin externally, on each side, from the back of the xiphoid cartilage; from the six lower ribs on the inner surface; from the two arched ligaments, H and G; and from the side of the spinal column by the crus, E. All the fleshy fibres end internally in the central tendon, to which they are directed with varying lengths and inclinations.

It is arched unequally on the two sides, being highest on the right. Its surfaces look upwards and downwards to the thoracic and abdominal cavities; and they differ in form, for the upper is convex, and the lower concave. In contact with the upper are the viscera and membranes of the thorax; and the lower, clothed by the peritoneum, touches the larger viscera in the abdominal cavity. Three large tubes—two for the conveyance of blood (aorta and cava), and one of the food (œsophagus)—pass through the muscle; and smaller apertures for the transit of vessels and nerves exist on each side. In the dead body the muscle is arched higher on the sides than in the centre, and the bulge on the right is higher than that on the left. The right curve descends as high as the upper border of the cartilage of the fifth rib near the sternum, and the left reaches in like manner to the level of the sixth rib. By the action of this muscle the cavities of the abdomen and thorax are enlarged and diminished, and the viscera are compressed and relaxed alternately.

During contraction or shortening of the fibres the muscle moves down

slightly in the cavity of the abdomen, diminishing this space and enlarging the thorax; and as the fleshy or lateral part moves more than the central or tendinous the whole muscle resembles in form a flat-roofed tent. In consequence of an increase in the size of thorax during its contraction it acts as an inspiratory muscle. By the descent above indicated the viscera in the upper part of the abdomen are forced down; and if the diaphragm be fixed in that position, whilst the abdominal muscles are contracted, the viscera will be compressed between the two, and the contents of some may be expelled.

When the shortened fibres relax and lengthen the muscle is moved one rib higher on both sides than its level in the dead body; and it diminishes in this way the cavity of the thorax, whilst it increases proportionally that of the abdomen. By causing a decrease in the cavity of the thorax it becomes an expiratory muscle. In its ascent the viscera of the thorax are raised, especially the heart, and those in the abdomen regain their usual place.

Named parts of the muscle. These are three, viz., the central tendon, the pillars, and the arched ligaments.

The *central tendon*, not attached to bone, is a thin aponeurotic layer, which is shaped like a trefoil leaf, and has been called heart-shaped or cordiform. It receives by its circumference the fleshy fibres, and is pierced by the large inferior cava: it is divided into three pieces;—a central, B; a left narrow portion, C; and a right piece, D.

The *crura* or *pillars* lie on the sides of the aorta, *a*, and form two thick fleshy bundles, which are fixed by tendon to the subjacent lumbar vertebræ and their intervertebral substance. Of the two, the right crus is larger than the left, and in the succeeding Plate it may be seen more distinctly. From the tendinous part the fleshy fibres ascend to the central tendon, but the most internal set pass between the aorta and the œsophagus, decussating with their fellows, and bound laterally the œsophagean opening in their upward course to their destination. Most commonly the fasciculus of the right side is anterior to that of the left at the point of crossing.

The *arched ligaments* are fibrous bands over the loin-muscles for the purpose of giving attachment to the hinder fibres of the diaphragm.

The internal one, G (ligam. arcuat. intern.), the longest and most curved, lies over the psoas muscle. By the inner end it joins the tendinous part of the crus, and by the outer it is inserted into the transverse

process of the first lumbar vertebra. The external band, H (lig. arc. extern.), is attached externally to the last rib, and internally it blends with the inner ligament: it is placed over the quadratus muscle, I, and under or through it the last dorsal nerve and the accompanying vessels issue.

Apertures in the diaphragm. Three large central holes give passage to the œsophagus and the two large bloodvessels of the lower half of the body; and on each side of the aorta is a fissure in the crus for the transmission of the splanchnic nerves.

The *œsophagean opening* occupies the fleshy part of the muscle behind the central tendon. It is placed in front of the spinal column, above and to the left of the aortic opening. Its bounding fibres are derived from the crura, those on the left side coming from the right crus; and the opposite. Through this aperture are transmitted the œsophagus, and the two pneumo-gastric nerves, with areolar tissue. It is larger than the tube passing through; and it will be reduced in size by the contraction of the fleshy fibres.

The *opening for the vena cava* (for. quadratum) lies on the right of the œsophagean, and higher than it. It is situate in the central tendon near the back part. Its margins blend with the coat of the vein, except on the inner side; and its size will not be diminished during the contraction of the fleshy fibres of the diaphragm. It gives passage to the vena cava inferior, and some areolar tissue.

The *aortic opening* is rather behind than in the diaphragm, and is opposite the last dorsal vertebra. Laterally it is bounded by the pillars of the diaphragm; and in front by a narrow tendinous band which intervenes between the crura. Through it pass the aorta, the thoracic duct, and the large azygos vein, with areolar tissue.

The *fissure for the splanchnic nerves* (Plate xxxvii.) lies in the fleshy part of the crus, and transmits on the right side the splanchnic nerves. Through that on the left side, besides the three corresponding nerves, passes the small azygos vein.

The *psoas magnus* muscle, K, occupies the loins, and leaves the abdomen beneath Poupart's ligament to be attached to the femur with the iliacus.

The muscle arises from the bodies of the lumbar vertebræ and their intervertebral substance; from the body of the last dorsal; and from the transverse processes in the loins by aponeurotic slips. Inferiorly it ends

in a tendon, which is continued to the thigh, and is inserted into the small trochanter of the femur.

The *psaos* lies beneath the kidney and the ureter and the spermatic vessels. At the attachment to the lumbar vertebræ fibrous arches span over the lumbar vessels; and along its inner edge below the spinal column rest the external iliac vessels. The outer edge overlays the *quadratus lumborum*, I, and the *iliacus*, L, and some nerves of the lumbar plexus.

If the femur is free to be moved this muscle will raise it towards the abdomen, bending the hip-joint, and afterwards will rotate out the limb. When the limb is immovable, as when it supports the weight of the body, the muscle will draw forwards the trunk over the femur, as in stooping. In standing the lumbar part of the spine is kept erect by the action of both muscles; or is bent to the side by one.

The *psaos parvus* muscle, J, appears to be but a part of the large *psaos*: it is often absent.* It takes origin from the bodies of the last dorsal and first lumbar vertebræ, and from their intervertebral substance; and it ends below in a strong tendon, which is inserted into the fore part of the brim of the pelvis, blending with the iliac fascia. Near the ribs the muscle lies on the *psaos magnus*, but slips to the inner side of this muscle below.

As the muscle is not fixed to the femur it cannot act on the hip-joint. In the recumbent posture it may raise forwards the pelvis; and in standing it assists the large *psaos* in supporting and bending forwards the lumbar part of the spine.

Quadratus lumborum, I. This muscle fills the space between the last rib and the iliac crest, and is best displayed in Plate xxxvii. Two to three inches wide below, the muscle arises from the ilio-vertebral ligament, and the crest of the hip-bone behind that band: it is inserted internally into the transverse processes of the four upper or all the lumbar vertebræ, and into the last rib and the body of the last dorsal vertebra.

The *quadratus* is partly concealed by the *psaos*, and is contained in a sheath derived from the fascia *lumborum*. Nerves from the lumbar plexus cross it, and the last dorsal nerve lies along the outer edge.

When the muscle acts from the pelvis it can render firm the last rib so as to give a fixed point for the action of the diaphragm in deep inspiration. If both muscles act on the spine they will assist the *psaos* muscles

* This muscle was found but once in twenty bodies which were examined carefully by Theile. "Lehre von den Muskeln." Leipzig, 1841.

in maintaining it erect; but if only one is active the spine will be inclined towards the same side. In climbing it will assist the abdominal muscles in raising the pelvis.

The *iliacus muscle*, D, arises from the iliac fossa of the hip-bone, and from the base of the sacrum; from the ilio-vertebral ligament behind; and from the capsule of the hip-joint in front. Many of the fibres join internally the tendon of the psoas muscle, but the rest pass beneath Poupart's ligament, and are inserted into the femur in front of, and below the small trochanter.

On the right muscle rests the cæcum, and on the left the sigmoid flexure of the colon. Below the pelvis the muscle covers the hip-joint; and as it passes over the anterior edge of the hip-bone, a small bursa lies underneath it.

If the lower limb is free the iliacus assists the psoas in flexing the hip-joint; and if the limb is fixed the muscle will bring forwards the pelvis on the head of the femur.

Lymphatic glands, † †. A chain of glands lies by side of the large bloodvessels. From these glands small efferent vessels are continued upwards to unite with the thoracic duct near the beginning (Plate xxxvii.).

BLOODVESSELS OF THE ABDOMEN.

A large arterial, and a venous trunk traverse the abdomen:—the former (aorta) supplies offsets in the cavity, and a large vessel to each limb: the latter (vena cava), formed by the union of two large veins, one from each limb, gathers smaller branches from the abdominal walls and the viscera.

- a. Aorta.
- b. Common iliac artery.
- c. Internal iliac artery.
- d. External iliac artery.
- e. Diaphragmatic artery.
- f. Coeliac axis.
- g. Upper mesenteric artery.
- h. Renal artery.
- i. Spermatic artery.
- j. Supra-renal artery.
- k. Inferior mesenteric artery.
- l. Lumbar arteries.

- n. Middle sacral artery.
- p. Vena cava inferior.
- q. Common iliac vein.
- r. External iliac vein.
- s. Lowest intercostal artery.
- t. Renal vein.
- u. Supra-renal vein.
- v. Spermatic vein.
- w. Lumbar vein.
- x. Middle sacral vein.
- y. Circumflex iliac artery.

The *aorta*, *a*, the main vessel of the body, extends through the thorax and abdomen. The part in the latter cavity is called abdominal, and reaches from the opening in the diaphragm to the left side of the fourth lumbar vertebra, where it bifurcates into the common iliac arteries, *b*. This large trunk rests on the vertebral column behind the viscera and the peritoneum, and is crossed by the left renal vein, *t*. Its offsets are visceral and parietal.

The *visceral branches* are the following: three spring from the front of the vessel, viz., coeliac axis *f*, upper mesenteric *g*, and inferior mesenteric *k*; and three pairs of branches, which come from the sides, are the supra-renal *j*, the renal *h*, and the spermatic *i*. Only the lateral visceral branches remain in the dissection, the former set having been cut necessarily in the removal of the viscera.

The *renal artery*, *h*, is directed almost horizontally outwards to the kidney, and divides near that viscus into branches which enter it between the vein and ureter. The artery of the left side is not so long as that on the right.

The *supra-renal* or middle capsular artery, *j*, taking the same direction as the renal, enters the supra-renal body. In the foetus it is larger than in the adult.

The *spermatic artery*, *i*, arises near the renal (the testicle developing in the loins), and descends over the psoas and the external iliac artery to the internal abdominal ring: at this spot it leaves the abdomen to reach the testicle. On the right side the artery crosses the vena cava.

Originally the spermatic vessels were short and straight, like the renal, but their increase in length is brought about by the testicle passing from the place of growth in the abdomen to the scrotum.

Parietal branches. The arteries that are furnished to the wall of the belly are the diaphragmatic, the lumbar, and the middle sacral.

The *diaphragmatic*, *e*, are the first two branches of the aorta in the abdomen, and ramify on the under surface of the diaphragm. Each courses over the fleshy fibres of the muscle to the front, and furnishes an offset towards the hinder part.

The *lumbar arteries*, *l*, four in number on each side, arise from the back of the aorta, and correspond with the intercostals in the thorax: their distribution is more evident in Plate xxxvii.

The *middle sacral artery*, *n*, arises from the point of splitting of the aorta, and descending beneath the left common iliac vein, runs along the

middle of the sacrum to the end of the spinal column. Small offsets are supplied from it opposite each vertebra.

The *common iliac artery*, *b*, is the primary trunk derived from the bifurcation of the aorta. About two inches in length it reaches as far as the fibro-cartilage between the last lumbar vertebra and the base of the sacrum: at this spot it ends by dividing into external and internal iliac arteries. Of the two vessels the right is more oblique in direction, and longer than the left. Each artery lies against the spinal column, and is placed beneath the peritoneum, like the aorta; it is crossed by several offsets of the sympathetic nerve, and sometimes by the ureter, *P*.

On opposite sides of the body its connections with other vessels are different. On the left, the iliac trunk is crossed by part of the inferior mesenteric artery, *k*; and its companion vein, *q*, lies nearer the pelvis. On the right side the iliac artery touches three large venous trunks; thus the right common iliac vein is external to it, the left common iliac vein crosses beneath it, and the beginning of the vena cava is placed on the outer side opposite the fifth lumbar vertebra.

Only small glandular offsets are furnished, as a rule, by the common iliac trunk, but a renal or an ilio-lumbar artery will take origin from it occasionally.

Ligature.—The length of the arterial trunk, and the origin of branches influence greatly the chances of a successful ligature of it. If the vessel is less than an inch in length it is too short for the application of a string without hæmorrhage ensuing on the separation of that band; in such a condition ligature of the beginning of the external and internal iliac would be preferable to tying the trunk which is too short (Quain). If during an operation an uncommon branch should be seen to spring from the iliac artery it should be included in the ligature, in order that its disturbing influence on the obliteration of the vessel may be removed.

Internal iliac artery, *c*. This is the smallest of the two vessels resulting from the bifurcation of the common iliac trunk: it enters the pelvis, furnishing branches to that cavity, and is shown in Plate xxxvii.

The *external iliac artery*, *d*, courses along the psoas muscle to the lower limb, and reaches from the base of the sacrum to the lower border of Poupart's ligament. Its position will be marked on the surface of the abdomen by a line from the left of the umbilicus to a spot midway between the symphysis pubis and the iliac crest. Throughout its length it is covered by the peritoneum and subperitoneal fat, and a chain of lym-

phatic glands lies along its side. Near Poupart's ligament it is crossed by several small vessels (p. 53). On the left side the large intestine crosses the artery.

Its companion vein is internal on the left side; but on the right side, the vein is on the inside near Poupart's ligament, and on the outside near the sacrum, crossing under the artery.

Two *branches*, epigastric and circumflex iliac, arise from the artery near the end: they have been noticed before (p. 54). Ligature of the vessel should be practised rather below its middle (p. 53).

Muscular branches in the abdomen. In the diaphragm small terminal offsets of the intercostal arteries ramify, and anastomose with the other arteries to the muscle. To the quadratus, I, and iliacus, L, branches of the lumbar and ilio-lumbar arteries are furnished.

Abdominal veins. Each of the large arterial trunks above described has its companion vein, whose anatomy is similar to that of the artery.

The *external iliac*, *r*, has the same limits as the artery of the same name, and is provided also with two branches, viz., circumflex iliac and epigastric. Its position to the artery varies on the two sides: thus the left lies inside and below, and the right crosses underneath its artery from the inner to the outer side.

The *common iliac*, *q*, is formed by the union of the pelvic vein (internal iliac) and of the lower limb vein (external iliac); the veins of opposite sides blend in the vena cava inferior opposite the last lumbar vertebra, so that the veins do not reach so high as the arteries of the same name. Two veins, ilio-lumbar and lateral sacral, enter each trunk; and the middle sacral is received into the left common iliac.

The following are the differences between the veins of opposite sides:—In length the left exceeds the right. In position to the companion bloodvessel they vary on the two sides of the body, for instance, the right is external to and above its artery, whilst the left lies below, and passes also beneath the right common iliac artery.

The *inferior cava* (vena cava ascendens) conveys to the heart the blood of the lower half of the body. Placed on the right side of the spine, it begins opposite the body of the fifth lumbar vertebra by the union of the common iliac veins, and passing through the diaphragm enters the right ventricle of the heart: it is therefore longer than its companion artery, the aorta.

Covered in front by the peritoneum like the most part on those branches of the aorta which viz., lumbar, renal, capsular, and diaphragmatic crosses over it. For about an inch and a half surrounded by the liver.

Its branches are parietal and visceral like the former set, the smallest, consists of lumbar

Visceral veins from the alimentary tube and corresponding with the coeliac axis and mesenteric directly the cava, but blend into one—the vena porta ramifies through the liver; and the circulating blood to the cava by large veins—venæ cavæ hepaticæ. In the dissection these veins were necessarily cut from the liver.

The visceral veins from the supra-renal bodies and testicle, are received into the cava as separate veins but the corresponding veins on the left side join, and the blood from all three is transmitted by this vein.

Occasionally the cava lies on the left of the aorta, then receiving the left renal vein, it crosses the aorta

SPINAL NERVES IN THE ABDOMEN

All the nerves now visible, except two, come from the plexus in the psoas muscle. In the next Plate the origin of the plexus is brought under notice.

- | | |
|--|--------------------------------|
| 1. Last dorsal nerve. | 5. Genital nerve. |
| 2. Ilio-hypogastric branch. | 6. External iliac branch. |
| 3. Ilio-inguinal branch. | 7. Anterior iliac branch. |
| 4. Crural branch of genito-crural nerve. | 8. Ending in the crural nerve. |

Branches of lumbar plexus. The position of the plexus to the psoas muscle is the following:—Along the psoas four nerves; two at the upper part, viz., the ilio-hypogastric and ilio-inguinal; one about the middle—the external iliac; and one at the lower part—the crural.

*The right renal vein joins the cava frequently between the two shortest of the two.

Covered in front by the peritoneum like the aorta, it rests for the most part on those branches of the aorta which are directed to the right, viz., lumbar, renal, capsular, and diaphragmatic; but the right spermatic crosses over it. For about an inch and a half from the diaphragm it is surrounded by the liver.

Its branches are parietal and visceral like the offsets of the aorta. The former set, the smallest, consists of lumbar and diaphragmatic.

Visceral veins from the alimentary tube and its glandular viscera, and corresponding with the cœliac axis and mesenteric arteries, do not enter directly the cava, but blend into one—the vena portæ. This single trunk ramifies through the liver; and the circulating blood is finally conveyed to the cava by large veins—venæ cavæ hepaticæ—close to the liver. In the dissection these veins were necessarily cut across by the removal of the liver.

The visceral veins from the supra-renal* body, the kidney,* and the testicle, are received into the cava as separate vessels on the right side; but the corresponding veins on the left side join the left renal vein, and the blood from all three is transmitted by this single channel to the cava.

Occasionally the cava lies on the left of the aorta as high as the kidney: then receiving the left renal vein, it crosses the spine into its usual place.

SPINAL NERVES IN THE ABDOMEN.

All the nerves now visible, except two, come from the lumbar plexus in the psoas muscle. In the next Plate the origin of the nerves from the plexus is brought under notice.

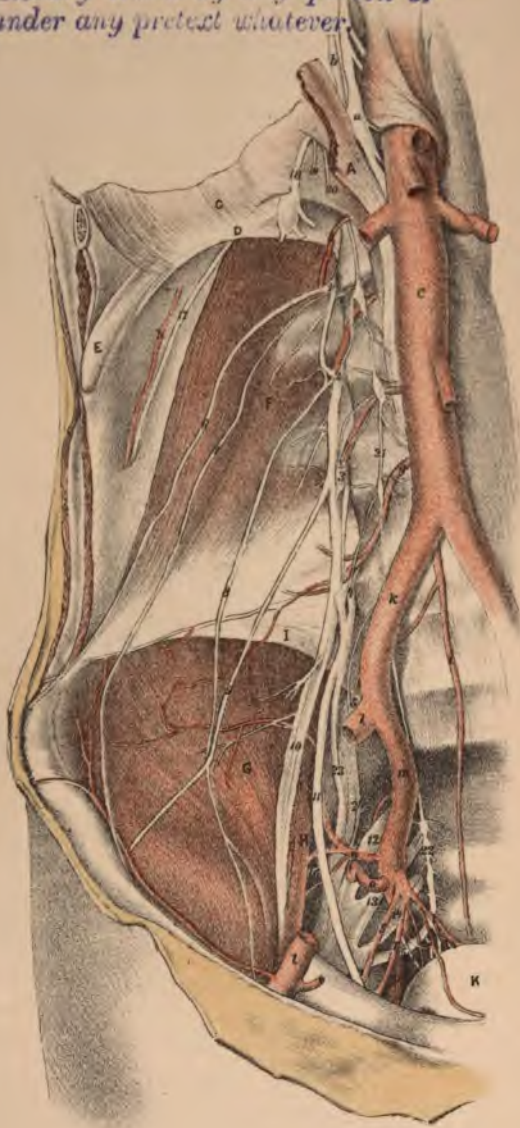
- | | |
|--|-------------------------------------|
| 1. Last dorsal nerve. | 5. Genital branch of genito-crural. |
| 2. Ilio-hypogastric branch. | 6. External cutaneous branch. |
| 3. Ilio-inguinal branch. | 7. Anterior crural nerve. |
| 4. Crural branch of genito-crural nerve. | 8. Ending of phrenic nerve. |

Branches of lumbar plexus. The position of the branches of the plexus to the psoas muscle is the following:—Along the outer edge appear four nerves; two at the upper part, viz., the ilio-hypogastric and ilio-inguinal; one about the middle—the external cutaneous; and a large

*The right renal vein joins the cava frequently higher than the left: it is also the shortest of the two.



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nerve below—the anterior crural. Rather below the pelvic part of the inner edge of the muscle the obturator nerve courses forwards (Plate xxxvii.). Piercing the fibres of the muscle will be one or two pieces of the genito-crural nerve; this difference depending upon the division of the nerve nearer to, or farther from its origin in the plexus.

All these branches are distributed outside the cavity of the abdomen, ending in the abdominal wall, the lower limb, and the cutaneous and fleshy coverings of the spermatic cord.

Ending of the phrenic nerve, 8. Some of the terminal branches of this nerve pierce the fibres of the diaphragm, and run on the under surface of the muscle before disappearing in the fleshy fibres. On the abdominal surface of the muscle they communicate with branches of the sympathetic nerve forming a plexus. At the place of union a ganglion exists on the right side (Swan).

Last dorsal nerve, 1. This trunk appears below the last rib, and enters the wall of the belly to be distributed in it, like the other intercostal nerves: it can be seen more plainly in the following Plate.

DESCRIPTION OF PLATE XXXVII.

THIS Illustration shows the dissection of the lumbar and sacral plexuses of spinal nerves, and that of the internal iliac artery.*

For the preparation of the parts displayed the psoas muscle and the veins of the right side of the abdomen were taken away; the external iliac vessels were cut through and removed; and the peritoneum and fat, and the internal iliac vein and its branches, were cleared from the pelvis.

DEEP MUSCLES OF THE ABDOMEN.

The muscles now brought into view were referred to in detail in the last Plate, but the quadratus lumborum can be better learnt in this

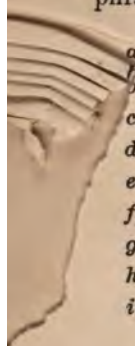
* Usually the lumbar plexus and the internal iliac artery are dissected on opposite sides of the body, but both have been here joined in one view on the right side, so as not to increase unnecessarily the number of Plates.

Figure. Only a small part of the diaphragm, C, has been left; and the right crus has been cut through to allow the beginning of the thoracic duct, and the large azygos vein to be seen.

- | | |
|--|-----------------------------|
| A. Right crus of the diaphragm divided. | E. Twelfth rib,—right. |
| B. Left crus of the muscle. | F. Quadratus lumborum. |
| C. Flethy lateral part of the diaphragm. | G. Iliacus muscle. |
| D. External arched ligament. | H. Psoas muscle, cut. |
| | I. Ilio-vertebral ligament. |
| | K. Urinary bladder. |

ABDOMINAL AND PELVIC ARTERIES.

In this Plate the aorta is represented in outline with the origin of the visceral branches; and its lumbar offsets are traced back to their exit from the abdomen. In the cavity of the pelvis the internal iliac artery and its branches are displayed; and in the aortic opening of the diaphragm the thoracic duct and azygos vein appear.

- 
- | | |
|---|-----------------------------------|
| a. Thoracic duct. | k. Common iliac artery. |
| b. Large azygos vein. | l. External iliac. |
| c. Aorta. | m. Internal iliac. |
| d. First lumbar artery. | n. Ilio-lumbar branch. |
| e. Second lumbar. | o. Gluteal artery. |
| f. Third lumbar. | p. Sciatic branch. |
| g. Fourth lumbar. | r. Pudic branch. |
| h. Last intercostal artery. | s. Obturator branch. |
| i. Middle sacral artery giving a lumbar branch. | t. Visceral offsets of the iliac. |
| | v. Lateral sacral branch. |

Lumbar arteries, d, e, f, g. Four in number, they belong to the parietal branches of the aorta; but in this body a fifth lumbar springs from the middle sacral artery: they are named first, second, etc., like the vertebræ.

The vessels are directed backwards along the bodies of the vertebræ under the crus of the diaphragm and the psoas, and each divides into two (dorsal and abdominal branches) between the transverse processes. The dorsal branches are continued onwards in the direction of the parent vessel, and supply the back, the contents of the spinal canal, and the vertebræ; the abdominal branches enter the hinder part of the abdominal

wall, and anastomose with the intercostal above, and with branches of the internal iliac below.

The veins accompanying the lumbar arteries open into the inferior cava (Plate xxxvi.).

Last intercostal artery, h. Appearing below the last rib with the last dorsal nerve, it pierces the fascia lumborum. and is distributed with its nerve in the wall of the abdomen.

The *internal iliac artery, m*, supplies the pelvic viscera, and maintains anastomoses outside the pelvis with branches of the femoral trunk. It begins opposite the base of the sacrum in the bifurcation of the common iliac artery, *k*, and descends into the pelvis towards the great sacro-sciatic notch, where it divides into two pieces—anterior and posterior. From its extremity a partly obliterated vessel (hypogastric) is continued forwards on the bladder to the umbilicus in the adult (Plate xxxviii., *d*), but this is open in the foetus and forms the main vessel.

Surrounded by much fat the artery measures about one inch and a half in length, and lies commonly on the lumbo-sacral cord and the first sacral nerve. Its companion vein is placed between it and the pelvis; but inclines to the outer part on the right side.

Ligature. The extent of this as of the other iliac arteries is subject to great variations, but its length commonly is from one inch to one inch and a half. Should ligature of the vessel be required during life the length ought to amount to one inch. And should it be found shorter in an operation, say only half an inch, tying both the iliac arteries would be safer than putting a string on the one (Quain).

Branches of the iliac. These are numerous, and are classified commonly into two sets, which come from the two pieces (anterior and posterior) into which the artery divides; but the origin of the branches deviates greatly from the prescribed arrangement. They may be arranged in three classes, viz., branches distributed to the parietes of the pelvis on the inside, some exterior to the cavity, and others to the viscera.

The *internal parietal set* consists of the ilio-lumbar and lateral sacral arteries.

The *ilio-lumbar branch, n*, is directed outwards to the iliac fossa beneath the external iliac vessels: there it ramifies in the fossa, some offsets running on the surface of the muscle to the iliac crest, and others supplying the hip-bone. An ascending or lumbar branch anastomoses with the last lumbar artery.

The *lateral sacral* branches are two in number, upper and lower, and the upper is marked with *v*: they run on the side of the sacrum, supplying the pyriformis and coccygeus muscles, and send branches into the spinal canal through the anterior sacral apertures.

External parietal set. These are the gluteal, sciatic, pudic, and obturator: they are furnished to parts outside the cavity of the pelvis, and anastomose with branches of the femoral artery. Only a short piece of each branch is included in the dissection.

The *gluteal*, *o*, the largest of all, is directed backwards between the sacral nerves to the upper part of the great sacro-sciatic notch; it leaves the pelvis above the pyriformis muscle, and ends in the buttock.

The *sciatic artery*, *p*, descends to the lower part of the great sacro-sciatic notch, and passes from the pelvis below the pyriformis muscle: it ends in the buttock and the back of the thigh.

The *pudic* branch, *r*, takes a downward course with the preceding, and escapes from the pelvis between the pyriformis and coccygeus muscles; its distribution is exhibited in the Plates of the Perinæum.

The *obturator* artery, *s*, runs forwards across the pelvic cavity with the nerve of the same name to the sub-pubic foramen: external to the pelvis it supplies the obturator muscle and the hip-joint.

Visceral branches. In both sexes there are vesical and hæmorrhoidal arteries; and in the female there are in addition uterine and vaginal.

The *vesical branches*, *t*, three in number, come from the iliac, and the partly obliterated hypogastric artery (Plate xl.), and ramify in the upper and lower regions of the bladder.

The *middle hæmorrhoidal* artery arises most often in common with the lower vesical: it is small, and is distributed in the rectum.

Uterine and vaginal arteries. These branches, which are special to the female, are distributed as the names signify. The uterine is the larger, and is tortuous; and the vaginal is generally an offset of the middle hæmorrhoidal.

The *large azygos vein*, *b*, begins in a lumbar vein, and may communicate with the inferior cava. It enters the thorax through the aortic opening, receives most of the intercostal veins of both sides, and ends in the vena cava superior.

Thoracic duct, *a*. Opposite the last dorsal, or the first lumbar vertebra this tube begins in a dilatation—receptaculum chyli, between the aorta and the right crus of the diaphragm. Into this dilated part three

or four large lymphatic vessels from the mesenteric and lumbar glands are received. It ascends then through the thorax, and ends in the neck by joining the left subclavian vein.

The *ilio-vertebral ligament*, I, stretches between the transverse process of the last lumbar vertebra and the iliac crest of the hip-bone, opposite the hinder part of the iliac fossa: from the upper and posterior part the quadratus lumborum F takes origin, and from the front, the iliacus.

SPINAL NERVES IN THE ABDOMEN.

The anterior primary branches of the lumbar and sacral nerves are united into a large plexus along the side of the spinal column. After this union several branches are distributed to the limb; the crural offsets from the upper part belong to the front of the limb, and those from the lower part of the plexus enter the back of the thigh.

- | | |
|-----------------------------|------------------------------|
| 1. First lumbar nerve. | 11. Obturator nerve. |
| 2. Second lumbar. | 12. First sacral nerve. |
| 3. Third lumbar. | 13. Second sacral. |
| 4. Fourth lumbar. | 14. Third sacral. |
| 5. Fifth lumbar. | 15. Fourth sacral. |
| 6. Ilio-hypogastric branch. | 16. Superior gluteal branch. |
| 7. Ilio-inguinal branch. | 17. Last dorsal nerve. |
| 8. Genito-crural branch. | 23. Branch to lumbo-sacral. |
| 9. External cutaneous. | 24. Lumbo-sacral cord. |
| 10. Anterior crural. | 25. Sacral plexus. |

The *lumbar nerves* are five in number, and are marked 1, 2, 3, etc. They increase rapidly in size from the first to the last; and they communicate with each other, and with the knotted cord of the sympathetic, as soon as they escape from the intervertebral foramina. Small muscular offsets are furnished by the nerves to the psoas and quadratus.

Four of the nerves unite in the lumbar plexus, whilst the last or fifth enters the sacral plexus. Sometimes too the last dorsal is joined to the first lumbar by a small branch (dorsi-lumbar).

The *lumbar plexus* is formed by the intercommunication of the four highest nerves; and it is embedded in the large psoas muscle. Below, it is connected with the sacral plexus through the lumbo-sacral cord. Its

offsets, six in number, are furnished to the lower part of the abdominal wall, to the spermatic cord coverings, and to the front of the limb.

Ilio-hypogastric, 6, and *ilio-inguinal*, 7: these two branches arise in the first nerve, and come into sight at the top of the psoas muscle. Directed downwards and outwards across the quadratus lumborum to the iliac crest, they enter the wall of the belly, and end in the muscles and integuments (Plate xxx., p. 34). At the iliac crest the nerve, 6, gives a cutaneous offset to the buttock.

Genito-crural, 8. This branch comes from the second nerve, and the loop between the first two. Piercing the fibres of the psoas, it descends on the surface of that muscle towards Poupart's ligament, and divides into two.

The genital part, which is cut, leaves the abdomen with the spermatic vessels, and is distributed to the cremaster muscle.

The crural piece is continued below the ligament, and reaches the teguments of the front of the thigh.

The *external cutaneous*, 9, springs in the third nerve, and appears at the outer border of the psoas about the middle: the nerve leaves the belly beneath Poupart's ligament at the outer end, and ramifies in the teguments of the thigh.

The *anterior crural* nerve, 10, is the largest offset of the plexus: it receives most of the fourth nerve, and is joined by a large fasciculus from the nerves above. Emerging from beneath the psoas near Poupart's ligament, it lies in the hollow between that muscle and the iliacus. The nerve escapes from the abdomen beneath Poupart's ligament, and is supplied to the fore part of the limb.

In the abdomen it furnishes two or more branches to the iliacus muscle, and a small nerve to the coats of the femoral artery.

Obturator nerve, 11. Beginning in the third and fourth nerves, it comes into sight at the pelvic border of the psoas. It is then continued across the cavity of the pelvis to the sub-pubic aperture in the upper part of the thyroid foramen, and supplies the adductor muscles of the thigh.

The *lumbo-sacral* cord, 24, is formed by the whole of the fifth lumbar nerve, and by a fasciculus, 23, which is derived from the fourth nerve. This large cord enters the sacral plexus in the pelvis, and serves as the connecting nerve between this and the lumbar plexus.

Before the cord joins the first sacral nerve it gives origin to the *upper gluteal* nerve, 16; this branch passes out of the pelvis through the upper

part of the great sacro-sciatic notch with the gluteal artery and vein, and is distributed to muscles on the back of the pelvis.

Sacral nerves. Five in number like the lumbar nerves, they decrease in size from above down. Four of them issue from the spinal canal through the apertures in the front of the sacrum, and the fifth or last comes between the sacrum and the coccyx. The three highest, and part of the fourth, enter the sacral plexus; but the rest of the fourth joins the fifth nerve, and terminates in muscular and visceral branches. The fifth sacral joins the coccygeal nerve, and ends on the back of the coccyx.

The *sacral plexus*, 25, is formed chiefly by the union of the three upper sacral nerves with part of the fourth, as before said; and it is further joined by the large lumbo-sacral cord, 24, from above. Its component nerves blend together in a flat band, which rests on the pyriformis muscle.

Its branches are numerous:—Some belong to the external rotator muscles, and will be dissected with the buttock; others are prolonged to the back of the limb; and one is distributed to the perinæum.

Last dorsal nerve, 17. This lies below the last rib, and appears in the abdomen after passing through or beneath the external arched ligament, with its accompanying vessels. After a distance of about three inches, it pierces the posterior tendon of the transversalis muscle (*fascia lumborum*), and terminates in the abdominal wall. A separate small abdominal branch arises from the nerve before this leaves the abdomen.

KNOTTED CORD OF THE SYMPATHETIC.

In the abdomen the sympathetic consists of plexuses in front of the vertebral column, for the supply of the viscera; and of two gangliated cords, one on each side of the spine, which join the different spinal nerves. As the viscera have been removed from the abdomen only the knotted cords remain.

- 18. Great splanchnic nerve.
- 19. Small splanchnic.
- 20. Smallest splanchnic.

- 21. Lumbar part of the gangliated cord.
- 22. Sacral part of the cord.

The *lumbar part* of the gangliated cord, 21, lies along the inner border of the psoas muscle, and is covered on the right side by the vena cava

inferior. A ganglion exists, for the most part, opposite each vertebra; and from it offsets are prolonged internally and externally.

The *external branches*, two in number from each ganglion, join generally two spinal nerves.

The *internal branches* are directed over the aorta, and terminate in the large visceral plexuses.

The *sacral part* of the cord, 22, rests on the front of the sacrum internal to the row of apertures. Below, the cords of opposite sides are connected by a loop in front of the coccyx, on which there is situate a single median ganglion—the “ganglion impar.” The number of the ganglia is oftentimes less than that of the vertebræ; and those bodies are smaller in the pelvis than elsewhere. External and internal offsets are given from these as from the lumbar ganglia.

External branches, two in number, enter either one or two spinal nerves.

Internal or visceral branches, small in size, are continued from the first two ganglia to the nerve-centre in front of the sacrum, called the hypogastric plexus; the branches from the remaining ganglia ramify on the front of the sacrum, and form a plexus on the middle sacral artery.

Splanchnic nerves. These are three in number on each side, and take origin in the ganglia of the knotted cord of the sympathetic in the thorax. They are named large, small, and smallest, and pierce the fibres of the crus of the diaphragm.

The large splanchnic, 10, ends in one of the ganglia (semilunar), forming part of the solar plexus in the abdomen.

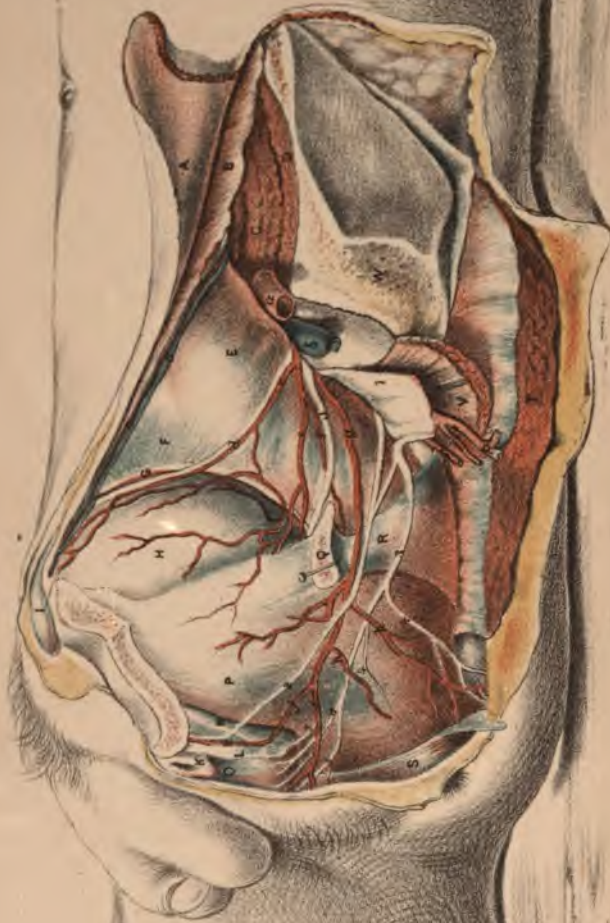
The small splanchnic, 19, terminates near the preceding in the lateral part of the solar plexus.

The smallest splanchnic, or renal nerve, 20, throws itself chiefly into the plexus for the kidney, and joins the solar plexus.

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DESCRIPTION OF PLATE XXXVIII.

FIRST view of the dissection of the pelvis, to illustrate the anatomy of the muscles closing the pelvic outlet.

For this side-view the left limb was removed by sawing through the hip-bone near the symphysis pubis in front, and near the articulation with the sacrum behind, the muscles of the abdominal wall having been previously divided by a cut from the one sawn part of the pelvis to the other. After forcibly abducting the hip-bone the pelvic fascia was detached, and the ischial spine was cut off with a bone forceps, and thrown down with its muscles.

A large quantity of fat will need removal from the perinaeal surface of the levator ani; from the pudic artery and nerve lying against that muscle; from the viscera in the pelvis; and from the branches of the internal iliac artery and the sacral plexus.

MUSCLES CLOSING THE PELVIC OUTLET.

Three muscles, viz., levator ani, coccygeus, and pyriformis, close on each side the elongated interval between the ilio-sacral articulation and the symphysis pubis. Other muscles of the abdominal wall, loins, and buttock, are shown cut through in the Figure.

- | | |
|-------------------------------------|-----------------------------------|
| A. External oblique muscle. | K. Crus penis, cut through. |
| B. Internal oblique, and the trans- | L. Anterior layer } of triangular |
| versalis. | N. Posterior layer } ligament. |
| C. Psoas magnus muscle. | O. Ejaculator urinæ muscle. |
| D. Iliacus muscle. | P. Levator ani muscle. |
| E. The rectum or large intestine. | Q. Ischial spine, cut off. |
| F. Bag of the peritoneum. | R. Coccygeus muscle. |
| G. Vas deferens of the testis. | S. Sphincter ani externus. |
| H. Urinary bladder. | T. Gluteus maximus muscle. |
| I. Spermatic cord. | V. Pyriformis muscle. |
| J. Ureter of the kidney. | W. Hip-bone, cut. |

The *pyriformis* muscle, V, arises by fleshy slips from the bodies of three sacral vertebræ (the first and last bones being free); from the lateral mass of the sacrum outside the anterior foramina; and from the upper part of the hinder border of the hip-bone, and the sacro-sciatic ligament. Leaving the pelvis by the great sacro-sciatic notch, it crosses the back of the hip-joint to be inserted into the great trochanter. See Plate of the Buttock.

In the pelvis the muscle lies beneath the sacral plexus, and some branches of the internal iliac artery; and on the left side the rectum rests on it. As it passes through the great sacro-sciatic notch it divides that space into two. In contact with the lower border is the coccygeus.

The *coccygeus* muscle, R, thin and triangular in shape, arises from the upper edge and the point of the ischial spine, Q, of the hip-bone; and it is inserted by a widened part into the front of the coccyx near the edge, and into the last piece of the sacrum.

Intermediate in position between the levator ani and the pyriformis, the muscle reaches by its lower edge the levator, and is separated from the pyriformis by the pubic and sciatic vessels and nerves. The pelvic surface touches the rectum on the left side, and the perinæal surface blends with the small sacro-sciatic ligament which partly conceals it: the muscle is crossed posteriorly by the pudic nerve.

The muscles of opposite sides support the pelvic viscera and the coccyx; and shortening by the contraction of the fibres, they will draw forwards the coccyx after the bone has been forced backwards.

Levator ani, P. The insertion of the muscle is shown in Plate xxx., and the origin appears in this side-view of the pelvis.

It arises in front from the back of the pubes just above the obturator internus, lower down from the fascia covering the obturator muscle, and, still lower, from the back of the triangular ligament, N; behind, from the lower border of the ischial spine, Q; and between those osseous attachments, from the under surface of the recto-vesical fascia. Its fibres are inclined down and back, and have the undermentioned insertion;—the most anterior unite below the triangular ligament with the muscle of the other side in the central point of the perinæum; others course backwards over the side of the gut, some joining the muscular coat of the intestine, to meet the fibres of the opposite muscle in a tendinous line between the gut and the coccyx; and the posterior fibres end on the lower
the coccyx.

By their position in the pelvic outlet the muscles form a fleshy diaphragm, which is convex to the perinæum and is pierced by the rectum. The outer surface looks to the wall of the pelvis and the ischio-rectal fossa; and the inner, to the bladder and urethra, and the rectum. The anterior border lies against the urethral tube in the male, and the urethra and vagina in the female; whilst the interval between the muscles of opposite sides is closed by the triangular ligament of the urethra.

When the levator ani contracts it raises the rectum; and it will restore to the natural position the lower end of the intestine which has been protruded, and everted in the passing of the fæces. It will also compress the lower part of the bladder, and the generative organs lying below and in front of that viscus. And as the muscles of opposite sides unite below the urethral tube in the male, and the vagina in the female, they will be able to constrict those passages. By means of the fibres attached to the coccyx the muscles will raise that bone with the aid of the coccygeus.

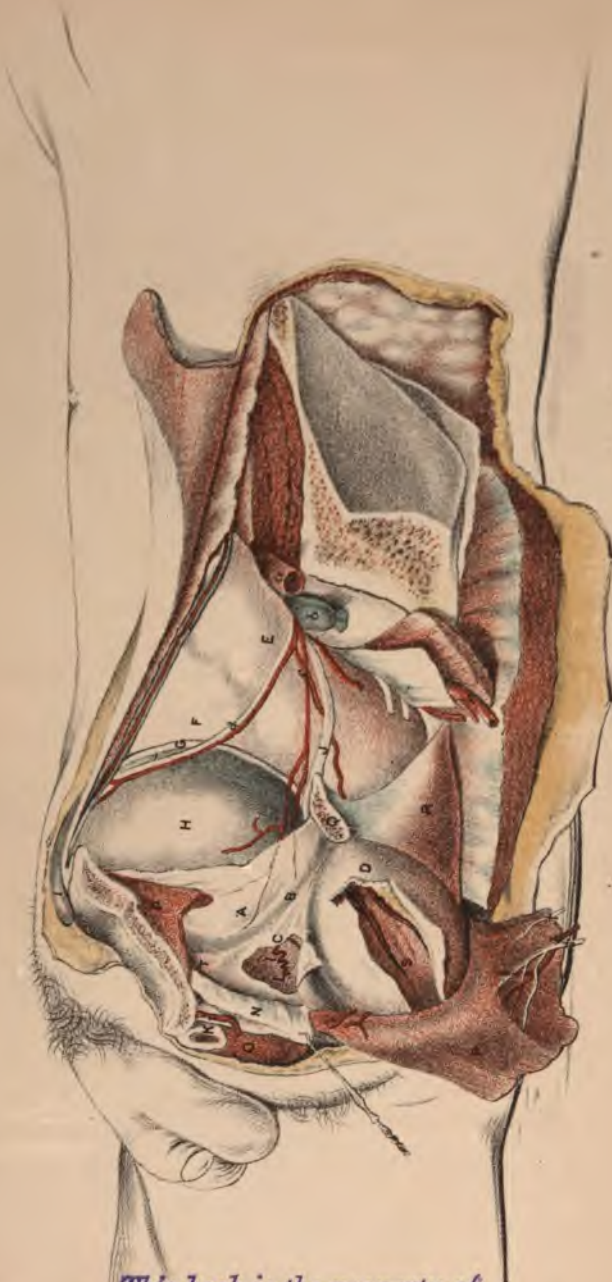
The *triangular ligament* of the urethra is described in p. 22. In this Figure the two layers are represented as they appear after the removal of the bone to which they are attached laterally. The two strata of which it consists are farther apart in the middle line than at the sides, and between them lie muscles, vessels, and nerves. Inferiorly, the layers blend together; and from the lower edge a thin fascia is prolonged over the levator ani muscle in the ischio-rectal fossa. In this view the posterior layer is seen to be pierced by the dorsal artery and nerve of the pudic; and to give attachment to the levator ani, P.

INTERNAL ILIAC ARTERY.

Visceral branches, and the obliterated hypogastric, are continued forwards from the end of the internal iliac; and these, with the pudic artery, are the chief vessels in the Figure. The other arteries, which are cut through, do not require further notice than that contained in the table of reference.

- a. Common iliac artery.
- b. Common iliac vein.
- c. Superior vesical artery.
- d. Obliterated hypogastric.
- e. Middle vesical artery.
- f. Inferior vesical artery.
- g. Pudic artery.
- h. Inferior hæmorrhoidal branch.

- i. Superficial perinæal branch.
- j. } Dorsal artery of the penis.
- k. }
- l. Artery of the bulb.
- n. Spermatic artery.
- o. Spermatic veins.
- p. Sciatic artery, cut.
- r. Branch of the sciatic.



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- | | |
|----------------------------------|-----------------------------------|
| 1. Sacral plexus. | 5. Superficial perinæal branches. |
| 2. Dorsal nerve of the penis. | 6. Branch to ejaculator urinæ. |
| 3. Perinæal nerve. | 7. Branch to constrictor urethræ. |
| 4. Inferior hæmorrhoidal branch. | |

The *pudic nerve* arises in the sacral plexus as one or two pieces, and has the same general course and distribution as the artery of the same name. Where it begins as a single trunk the parts, 2 and 3, are blended as far as the ischial spine, Q; but at this point they separate, one, inferior, reaching the perinæum, and the other, superior in position, being furnished to the penis.

The *perinæal* branch is directed forwards to the scrotum in which it ends; its offsets are these:—one or two inferior hæmorrhoidal branches, 4, to the muscles and integuments of the lower end of the rectum: two superficial perinæal branches, 5 (anterior and posterior), to the integuments of the scrotum; and branches to the muscles, and the part of the urethra in the perinæum, of which two, 6 and 7, are shown.

The *dorsal nerve* of the penis, 2, ascends along the side of the pelvis and the internal obturator muscle to the back of the triangular ligament; and takes its place between the layers of that membrane by penetrating the posterior layer higher than the dorsal artery of the penis. In company with the artery of the same name it ascends near to the symphysis pubis, perforates the anterior layer of the ligament, and is distributed to the body and the integuments of the penis.

DESCRIPTION OF PLATE XXXIX.

THE arrangement of the recto-vesical fascia is set forth in this second view of the dissection of the pelvis.

After dividing the levator ani near its origin, and throwing down that muscle, the recto-vesical fascia will become apparent. To demonstrate the existence of sheaths of the membrane on the prostate and the rectum, incisions may be made in a longitudinal direction into the fascia on those viscera, as in the Figure.

RECTO-VESICAL FASCIA.

This membrane is attached to the viscera, assisting to support them, and forms a partition between the pelvis and the perinæum. The same letters of reference for the same parts are used in this and the preceding Figure.

- | | |
|---------------------------------------|------------------------------|
| A. Recto-vesical fascia. | J. Ureter from the kidney. |
| B. Line of attachment to the viscera. | K. Crus penis, cut. |
| C. Sheath on the prostate. | L. Prostate. |
| D. Sheath for the rectum. | N. Triangular ligament. |
| E. Upper part of the rectum. | O. Ejaculator urinæ. |
| F. Bag of the peritoneum. | P. Levator ani, thrown down. |
| G. Vas deferens of the testis. | Q. Ischial spine, cut off. |
| H. Urinary bladder. | R. Coccygeus muscle. |
| I. Spermatic cord. | S. Rectum, lower part. |

The *recto-vesical fascia*, A, gives origin in part to the levator ani muscle, and partly joins the pelvic fascia. Before the hip-bone is removed the fascia may be seen to be attached to the wall of the pelvis above the origin of the levator ani, and to be directed inwards obliquely on that muscle to the viscera, where it meets with a similar piece on the opposite side, and forms a septum between the cavity of the pelvis and the perinæum. This septum is rather convex below, and is pierced by the lower part of the bladder and the rectum, so that the viscera are partly within the cavity of the abdomen, and partly outside the flooring or membranous boundary of that cavity. Though the viscera pass through the fascia there is not any passage leading from the pelvic cavity, for the margins of the apertures for their transmission are inseparably united to the parts transmitted. From the under or perinæal surface of the fascia are furnished two prolongations, like the fingers of a glove, which form sheaths for the prostate and the rectum.

As the fascia suspends the bladder, it forms the true ligaments of this viscus on each side, and in front. These will be noticed below.

The *sheath of the prostate*, C, derived from the recto-vesical fascia, as above said, blends at the front of that body with the posterior layer, N, of the triangular ligament. It gives a complete, though not very dense

covering, and is separated from the prostate by a plexus of veins, and by some small arteries.

Sheath of the rectum. This incases about the lower three inches of the gut, and is continued to the anus where it gradually ends. It is thicker than the tube on the prostate, and is separated from the intestine by fat, and by the upper hæmorrhoidal vessels.

Ligaments of the bladder. The part of the fascia intervening between the wall of the pelvis and the bladder constitutes, as before said, the true ligaments of that viscus: they are two in number on each side, anterior and lateral, but there is not any slit or division between them.

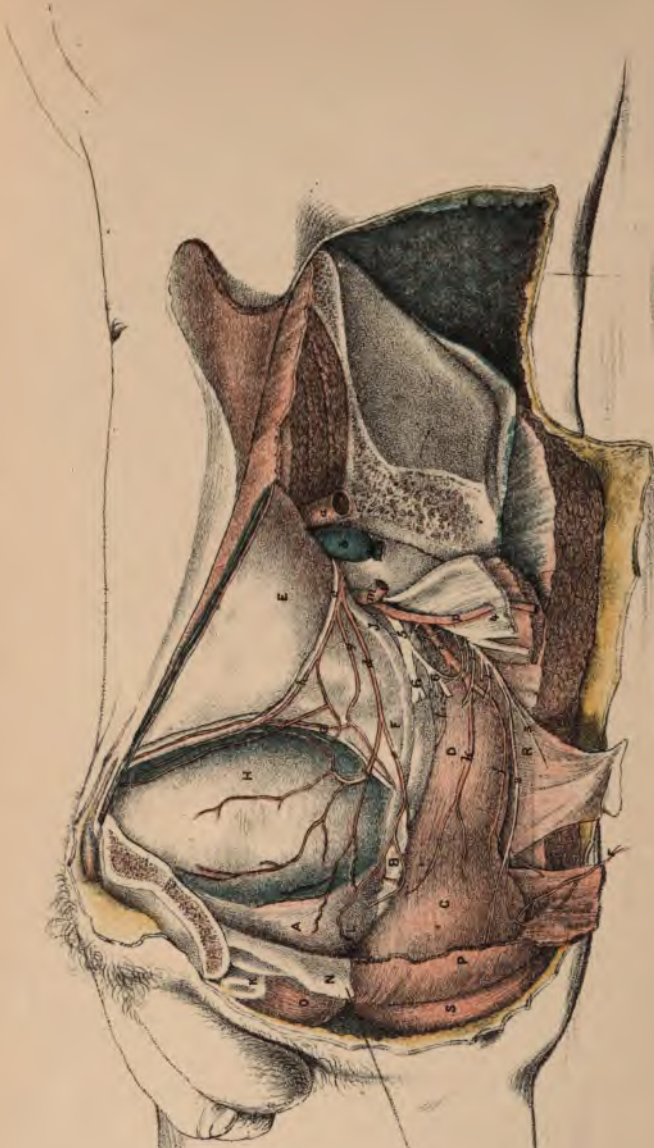
The *anterior*, T, is a narrow prominent band, which reaches from the back of the pubes to the sheath of the prostate and the neck of the bladder. It contains a bundle of muscular fibres derived from the external or longitudinal layer of the urinary bladder. A hollow exists between the ligaments of opposite sides.

The *lateral ligament* is the wide expanded part of the fascia, A, which is attached to the neck and side of the bladder above the vesicula seminalis, along the line, B. From its insertion a piece is continued under the bladder to incase, with a like piece from the opposite side, the vesicula seminalis in a sheath.

Ligament of the rectum? No name has been given to the part of the fascia which is attached to the gut; but from the ischial spine the membrane is continued to the intestine, and this part might be called the lateral ligament of the rectum, from its supporting that viscus.

From the arrangement of the recto-vesical fascia on the viscera it appears that the prostate, and the lower part of the rectum, lie below the septum or the membranous flooring of the abdomen, and may be reached from the perinæum without entering the cavity of the pelvis. About a finger's length of the intestine may be cut without passing the limits of the fascia; and all the prostate may be cut through in a direction downwards and backwards without injuring the septum. The reflection of the fascia with respect to the prostate demonstrates how division of this body can be made for the extraction of a stone from the bladder without entering the pelvis; and its disposition on the rectum will explain how the intestine may be slit in the operation for fistula in ano without serious consequences ensuing.

The attachment of the fascia to the side of the bladder indicates in what direction a cut is to be made in that viscus for the extraction of a



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some accessory parts of the generative apparatus, viz., the vesiculæ seminales with the vasa deferentia, and the prostate.

A. Anterior true ligament of the bladder.	H. Urinary bladder.
B. Vesicula seminalis.	J. Ureter.
C. Lower part	K. Crus penis, cut.
D. Middle part	L. Prostate.
E. Upper part	N. Triangular ligament.
F. Pouch of the peritoneum.	P. Levator ani, cut.
G. Vas deferens.	R. Coccygeus.
	S. Sphincter ani externus.

The *rectum*, or the lower part of the large intestine, begins opposite the articulation of the left hip-bone with the sacrum, and ends at the anus. Between those points it takes a bent course behind and below the bladder, and lies in the curve of the sacrum and coccyx. It measures about eight inches in length, and is divided into three parts.

The upper part, E, extends to the third piece of the sacrum; it is inclined inwards to the mid-line of that bone, and it is surrounded by the peritoneum which attaches it to the pelvic wall by a fold—the mesorectum. Branches of the left internal iliac artery, and the left ureter, are directed forwards by the side of the gut.

The middle portion, D, reaches to the end of the coccyx and the coccygeus muscle. It is about three inches long; and it is invested by the peritoneal pouch, F, which tapering gradually to a point, covers the sides and front of the intestine above, but only the fore part below. Resting behind on the sacrum and coccyx, it touches in front the under part of the bladder, with the vesiculæ seminales and the vasa deferentia. On each side descends the coccygeus, R.

The third piece, C, intervenes between the tip of the coccyx, and the anus; it measures about one inch and a half, and is curved backwards somewhat. It is destitute of serous membrane. Above, are the fore part of the prostate, and the membranous and bulbous parts of the urethra. It is incased by muscles;—the levatores ani of opposite sides covering and supporting it laterally and behind, and the external sphincter surrounding it at the anus. Its cavity is narrowed at the orifice on the surface; but above that point is a dilatation, which is greatly enlarged in old men so as to rise upwards on the sides of the prostate, and in which the fæces accumulate.

By the introduction of the finger into the rectum, the size and condition of the prostate may be ascertained; and by the same means assistance may be given sometimes in the recognition of a calculus in the bladder, for the finger can raise and bring within reach of the sound a stone that has fallen into the hollow of the bladder behind the prostate.

In the operation of puncturing the bladder through the rectum for retention of urine, a bent canula with a trocar is passed into the gut, and is guided by the fore finger to the under part of the bladder which is to be punctured, viz., the base between the vesiculæ seminales, and behind the prostate. But the instrument should not be introduced farther than three inches from the anus, lest the pouch, F, of the peritoneum should be injured.

As the arteries *j*, *k*, *l*, etc., which are directed longitudinally on the exterior, pierce the intestine and take a straight course inside to the anus, they will be best avoided in an operation by cutting parallel to them. The arrangement of these arteries lower down in the gut will be referred to afterwards.

The *urinary bladder*, H, receives the urine conveyed by the ureters, and assists through the contraction of its muscular wall in the expulsion of that fluid from the body. It is placed at the front of the pelvis, above the rectum, and is partly surrounded by peritoneum, which helps to retain it in situ.

Its form is determined by its degree of distention. When empty it is flattened, and is triangular in shape; but as it becomes distended it assumes a conical form, with the apex towards the abdominal wall and the base to the rectum. Its height in the abdomen varies with the degree of dilatation; for it lies below the brim of the pelvis in the contracted state, but as it expands it rises above the pelvis against the abdominal wall; and in extreme distention it is curved forwards over the pubes by the resistance opposed by the small intestines to its ascent.

When moderately dilated it measures about five inches in length, and three in diameter, and holds about a pint; but it is larger in the female than the male. Parts of it have received the following designations:—The upper end is named apex, and the lower, the base; the intervening portion is the body; and the term neck is given to the part surrounded by the prostate.

Connections of the bladder:—The apex touches the pubes, or the abdominal wall according to the distention. From it three cords are

continued to the umbilicus, viz., the obliterated hypogastric artery on each side, and the urachus in the middle. Behind the cords the bladder is covered by the peritoneum, but is free from that membrane in front of them.

The base or fundus rests on the middle piece of the rectum without the intervention of peritoneum. In contact with it on each side is the vesicula seminalis with the vas deferens; and the part between those bodies is called the triangular space of the bladder. The size of the base and its shape depend upon the distention; for as the bladder increases in size it projects towards the rectum, and forms a pouch below the level of the cervix and the canal of the urethra, into which a calculus will subside.

The body of the viscus touches in front the wall of the pelvis, and is free from peritoneum; and when the bladder is distended it rises above the pelvis, and can be reached without injury to the serous membrane, by an incision through the lower part of the abdominal wall. Behind, it is covered by the peritoneum, and is in contact more or less with the small intestines, which descend into the pelvis in some bodies. Laterally the obliterated hypogastric artery ascends along the viscus; and descending behind this is the vas deferens, which passes internal to the ureter and the vesicula seminalis. Nearer the fundus the ureter pierces the muscular wall. All the side behind the obliterated hypogastric is clothed by the peritoneum, whilst all in front of it is devoid of that layer; so that the cord of the obliterated vessel lies along the line of reflection of the serous membrane.

The neck or cervix is the narrowed part of the bladder which is surrounded by the prostate; and from it the urethra or the excretory canal of the urine is continued. In the contracted state of the viscus it is the lowest part of the cavity, but in distention it is placed considerably above the fundus.

The *ureter*, J, brings the urine from the kidney to the bladder. Crossing the common iliac vessels, it is continued through the pelvis to the bladder; and it pierces this, below, at the lateral aspect, and about one inch and a half from the prostate. In the pelvic cavity it forms an arch below that of the obliterated hypogastric artery.

Ligaments of the bladder. This viscus is retained in place partly by ligaments; of these there are two kinds, true and false.

The *true* ligaments consist of the pelvic fascia: they are attached to

calculus in the adult, which is larger than the prostate, or even of a stone of moderate size in the child. An incision carried downwards and backwards below the attachment, B, of the fascia, but paralld and close to it, would divide the viscus along the upper edge of the vesicula seminalis, and would be situate below the septal piece, A, and therefore below the cavity of the abdomen. In the case of such a cut being practised the urine would flow down to the perinæum, because the barrier presented by the septal part of the fascia would stop its progress in the opposite direction. Should, however, an incision be made upwards, in a direction towards the apex of the bladder, the knife would divide the septal piece of the fascia, and open up the cavity of the pelvis.

Vessels and nerves. Some of the arteries to the viscera, and a part of the sacral plexus, are shown in this and the preceding Plate; but they will be noticed in the description of the next Plate. The letters of reference by which they are marked are the same, for the most part, in all the Figures of the side-view of the pelvis.

<i>a.</i> Common iliac artery.	<i>i.</i> Dorsal artery of the penis.
<i>b.</i> Common iliac vein.	<i>l.</i> Prostatic artery.
<i>d.</i> Obliterated hypogastric.	<i>n.</i> Spermatic artery.
<i>f.</i> Inferior vesical.	<i>o.</i> Spermatic veins.
<i>g.</i> Branches of upper hæmorrhoidal.	<i>p.</i> Sciatic artery.
<i>h.</i> Artery to levator ani, cut.	†† Nerve to levator ani, cut through.

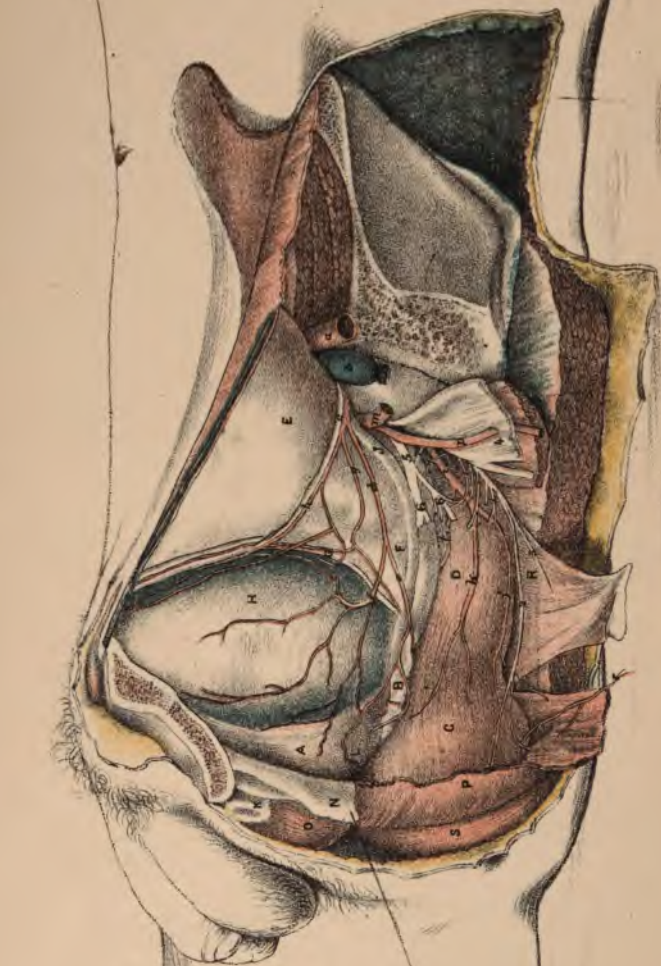
DESCRIPTION OF PLATE XL.

THE connections of the viscera of the male are given in this last side-view of the pelvis.

On removing the pelvic fascia, the areolar tissue, and the fat, the viscera will appear as they are represented in the Plate. The bag of the peritoneum may be left unopened.

CONNECTIONS OF THE VISCERA.

The two large viscera in the male pelvis are the urinary bladder and the rectum. And connected with the under surface of the bladder are



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directed forwards to the triangular ligament as long as the sheath of fascia around the prostate is entire, and then onwards along the membranous part of the tube.

VISCERAL ARTERIES OF THE PELVIS.

The visceral arteries are furnished from different sources:—Those for the bladder, and the generative organs beneath it are derived from the internal iliac artery; and those for the rectum come mainly from the inferior mesenteric artery—a branch of the aorta.

- | | |
|-------------------------------------|--------------------------------|
| a. Common iliac artery. | i. Upper hæmorrhoidal artery. |
| b. Common iliac vein. | j. } Branches of upper hæmor- |
| c. Obliterated hypogastric. | k. } rhoidal artery. |
| d. Inferior vesical artery. | l. } |
| e. Branch to vesicula and prostate. | m. Gluteal artery, cut. |
| f. Branch to the bladder. | p. Sciatic artery, cut. |
| g. Middle vesical artery. | r. Branch to levator ani, cut. |
| h. Upper vesical artery. | |

The *vesical arteries* are two or three in number: when there are three, as in the Plate, they have the undermentioned distribution.

The *upper vesical*, *h*, is the smallest, and accompanies the obliterated hypogastric, of which it appears to be a pervious part, as far as the top of the bladder: its offsets are few, and inconsiderable in size.

The *middle vesical*, *g*, supplies the body of the bladder, and communicates with the other arteries of that viscus.

The *inferior vesical*, *d*, ramifies in the fundus of the bladder, and gives branches to the vesicula seminalis, B, and the prostate, L. Usually it furnishes an offset to the rectum (middle hæmorrhoidal), but in this body the gut was not supplied by it. On the prostate the branches become tortuous.

Hæmorrhoidal arteries. The rectum is provided with vessels from three sources:—upper hæmorrhoidal, *i*; middle hæmorrhoidal from the internal iliac (Plate *XXI. g*); and inferior hæmorrhoidal from the pudic artery (Plate *XXIX. b*).

The *upper hæmorrhoidal*, *i*, is the termination of the inferior mesenteric trunk. Placed at first at the back of the rectum, it divides into six or seven branches about the middle of the gut: these descend around

the intestine, three being marked, *j*, *k*, *l*, and pierce the muscular coat about three inches from the anus. Inside that coat the branches are continued nearly to the anus, where they communicate together in a series of loops beneath the mucous membrane.

The *vein* accompanying the artery has a similar looped arrangement of its branches within the anus; and these loops projected through the anus, but altered in their structure and use, form hæmorrhoids (p. 10).

NERVES OF THE PELVIS.

Both spinal and sympathetic nerves are distributed in the pelvis.

- | | |
|---|---|
| <ol style="list-style-type: none"> 1. Vesical nerves. 2. Nerve to levator ani. 3. Nerve to coccygeus. 4. Sacral plexus, cut. 5. Left part of hypogastric plexus. | <ol style="list-style-type: none"> 6. Part of the pelvic plexus. 7. Offsets of the knotted cord of the sympathetic to hypogastric plexus. |
|---|---|

Spinal nerves.—These are supplied to some muscles, and to the viscera in part.

Only two of the *muscular branches* are shown: they are furnished by the fourth sacral nerve. The nerve marked, 2, belongs to the levator ani of the left side, and enters the inner surface; another nerve to the coccygeus, 3, penetrates into the fibres on the pelvic aspect of its muscle; and the third descends to the perinæum to supply the external sphincter (Plate XXIX. 5).

Nerves to the viscera, 1, are derived from the fourth or the third sacral nerve, and occasionally from both those nerves; they supply chiefly the lower part of the bladder, and before they reach that viscus they communicate freely with the pelvic plexus of the sympathetic.

Sympathetic nerve. One part of the sympathetic is distributed altogether to the viscera, and the other is a knotted cord in front of the sacrum: a similar arrangement exists on each side of the pelvic cavity. Only an outline of the visceral part is here sketched.

Hypogastric plexus. In front of the sacrum is a plexus of the sympathetic with this name; and on each side proceeds an offset, 5, in the form of a flattened band without ganglia. This prolongation communi-

cates with the knotted cord lying on the sacral vertebræ by means of the small nerves, 7, 7; and, below, it ends in the pelvic plexus.

Pelvic plexus. This is a large network on the side of the bladder and rectum, of which only a fragment is indicated by the figures, 6, 6. It receives, above, the part, 5, of the hypogastric plexus, and is joined behind by large branches from the spinal sacral nerves in the pelvis. Offsets are furnished by it to the bladder and the rectum, and to the vesicula seminalis, penis, and urethra; of these the nerves of the bladder are larger and whiter than the rest, and receive more spinal nerve-fibres.

A view of this plexus has been omitted from the Plate because its dissection is in general too difficult for the student to execute, and because the insertion of so large a mass of nerves would interfere with the sight of the pelvic viscera.

DESCRIPTION OF PLATE XII.

A SIDE view of the viscera of the female pelvis is portrayed in this Figure.

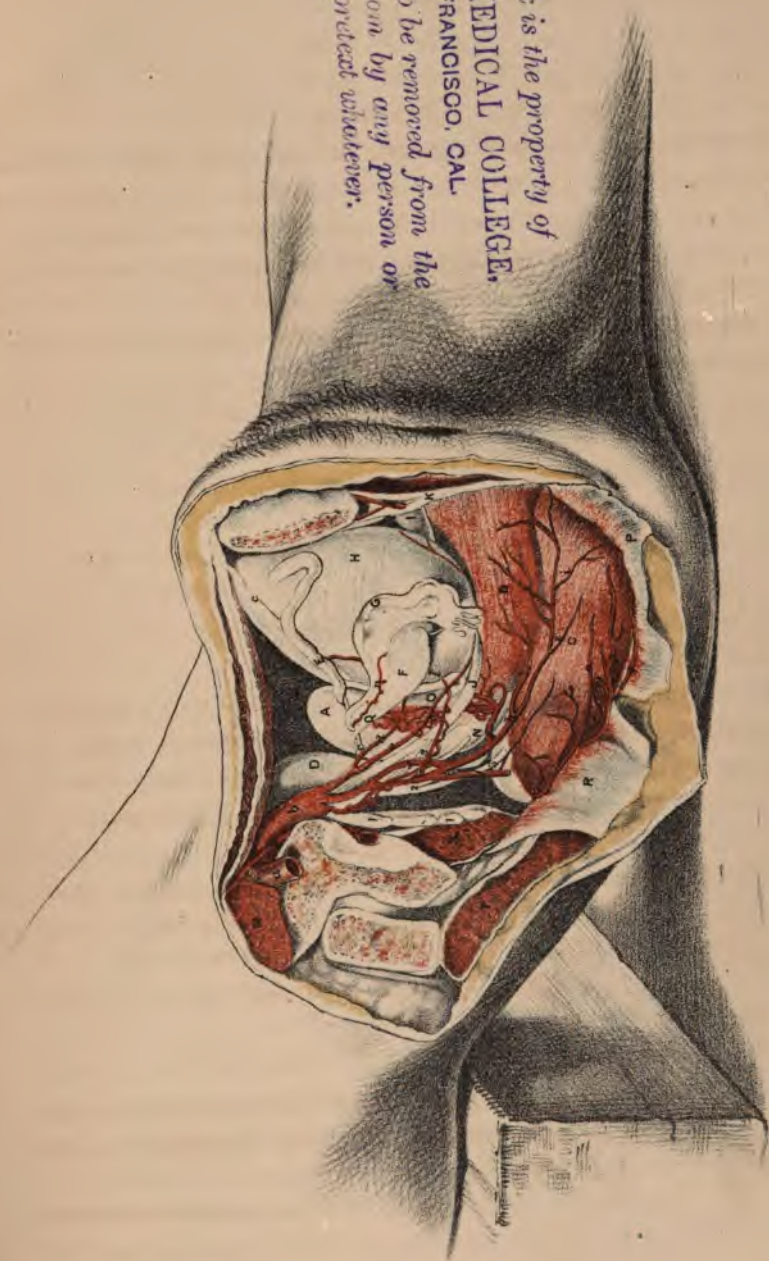
The right limb was detached from the trunk as the first step in the dissection; and the levator ani having been thrown down, the fat and fascia were removed from the vessels and the viscera. The peritoneum was taken away, in part, to demonstrate the extent of the pouches of that membrane before and behind the womb. For the purpose of supporting the hollow viscera, so as to render the cleaning of them more easy, some tow was introduced into the rectum and vagina, and air into the bladder.

CONNECTIONS OF THE PELVIC VISCERA.

In the female pelvis are contained the bladder and the rectum as in the male; and between them the uterus and the vagina are interposed.

A. Body of the uterus.	E. Round ligament of the uterus.
B. Vagina.	F. Ovary.
C. Lower part	G. Fallopian tube.
D. Upper part	H. Urinary bladder.
} of the rectum.	

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I. Urethral tube.	O. Vesico-uterine pouch.
J. Ureter.	P. Levator ani, cut.
K. Triangular ligament.	Q. Ligament of the ovary.
L. Constrictor vaginae.	R. Coccygeus muscle.
M. Psoas magnus, cut.	S. Pyriformis, cut.
N. Recto-uterine pouch.	T. Gluteus maximus, cut.

Rectum, C, D. This part of the large intestine has the same extent and curve in the two sexes; but in this body there was a deeper indentation than usual near the lower end of the sacrum.

Behind it are the sacrum and coccyx; and in front it touches the uterus and vagina, which separate it from the bladder and urethra. It pierces the recto-vesical fascia, like the gut in the male, and is uncovered by peritoneum for about three inches below. Its vessels and nerves are similar to those in the male.

Bladder, H. Like the corresponding organ in the other sex, it is the most anterior and superficial of the pelvic viscera, but it does not descend so low in the cavity of the pelvis as in man.

Its form differs somewhat from that of the male bladder: thus it is less deep, and is wider below from side to side than from before back; the under part or base is flatter, and does not project so much below the urethra.

The connections of the body of the viscus with parts around are similar to those of the male at each side, and in front; but they differ below and behind. Posteriorly the bladder touches the uterus; and inferiorly it rests upon the vagina.

The *urethra*, I, is a short narrow passage which reaches from the bladder to the vulva. It measures about one inch and a half in length, and is therefore much shorter than the urine-tube in the male.

Its position is above the vagina, and in its course to the exterior of the body it has the following connections. At first it is surrounded by the vascular structure of the vagina, so as to seem to form one mass with that tube before a separation has been made by dissection; then it pierces the triangular ligament of the urethra, and is surrounded by the fibres of the constrictor urethræ muscle between the layers of that structure; and lastly it ends in the bottom of the vulva, about a quarter of an inch above the opening of the vagina.

This short canal of the female answers to the prostatic and membranous parts of the male urethra (Plate XL.).

The *ureter*, J, differs from the corresponding tube of the other sex in having a longer course in the pelvis, and in crossing the side of the uterus before it reaches the bladder.

The *uterus*, or womb, A, is a thick muscular viscus with a small central cavity for the reception of the ovum. Somewhat pyramidal in form, with the larger end upwards, and flattened from before back, it measures about three inches in length, two in breadth, and one in thickness.

Its upper end, large and rounded, is named the fundus. About two-thirds down it decreases much in size; and this narrowed part, neck or cervix, is received into the vagina, B. The intermediate part of the viscus is the body. The anterior surface is flattened; the posterior is rounded; and the narrow sides slope gradually towards the neck.

The cavity in the interior is flat and triangular: it communicates below with the vagina by an oval opening, or the mouth of the uterus, *os tincæ*; and on each side above is a small round aperture into the Fallopian tube, G.

The uterus and the vagina are interposed between the bladder and the rectum; and the womb is supported in its place by ligaments connecting it to the abdominal wall. In the unimpregnated condition the uterus is placed below the brim of the pelvis; and it sinks down lower in the dead body. Its upper end is directed forwards, and the lower backwards; and a line through the centre would correspond with the axis of the inlet of the pelvis; if that line was prolonged upwards it would touch the abdominal wall a little above the pubes.

The anterior flattened surface touches the back of the bladder, and is covered in part by peritoneum: commonly the serous membrane reaches only half or two-thirds down, and the cervix is united by fibrous tissue to the bladder; but in the body from which the Figure was taken the whole of the anterior surface was clothed by that membrane. The posterior surface, rounded, is turned to the rectum, and is entirely covered by peritoneum.

The upper end is in contact with the small intestines, which descend into the pelvis in the woman; and the lower end is received into the vagina in such a way as to be covered higher behind than in front.

On each side the uterus gives insertion to a broad fold of peritoneum which is attached externally to the wall of the pelvis, and divides the cavity into two—an anterior, containing the bladder, and a posterior,

the rectum. In this fold are included the three uterine appendages, viz. the Fallopian tube, G; the round ligament, E, and the ovary and its ligament, F, and these are placed from above down in the order in which they are here enumerated.

The *vagina*, B, is a tube which reaches from the uterus to the vulva on the exterior of the body. It takes a curved course in front of the rectum, and below the bladder and urethra. The fore part is shorter than the hinder; and a line through it would correspond with the axes of the cavity and outlet of the pelvis.

When distended it is roundish in form, but in the natural state it is flattened from before back except at the ends. It measures about five inches in length.

In its course it pierces the recto-vesical fascia, receiving from this a sheath on the lower half; and it is transmitted through the lower part of the triangular ligament of the urethra. The upper end is attached to the neck of the uterus, reaching farther on the posterior than the anterior surface, and the lower end is surrounded by the constrictor vaginæ muscle, L. At the outer orifice in the child, and in the virgin state, there is an incomplete occluding structure called the *hymen*.

The *constrictor vaginæ*, L, is an orbicular muscle around the end of the vagina. It is attached in front on each side to the clitoris: from this spot the fibres pass back on the sides of the vaginal aperture, and end at central point of the perinæum, some joining the external sphincter ani.

The muscle constricts the vagina; and possesses at one time a voluntary, and at another an involuntary action, like the ejaculator urinæ by which it is represented in the other sex.

Peritoneum in the pelvis. The serous membrane is reflected over the viscera so as partly to cover and fix them to the wall of the pelvis, after a similar manner in both sexes.

Surrounding the upper half of the rectum it attaches the gut to the wall behind by a fold—the meso-rectum. In front of the intestine it is reflected on the back of the vagina and the posterior surface of the uterus, and forms the recto-uterine pouch between the womb and the rectum. On each side of the uterus it is extended outwards in a wide piece to the side of the pelvis, giving rise to the broad ligament, which contains and supports the Fallopian tube, G, the round ligament, E, and the ovary with its ligament, F. The membrane may be then traced over the front of the uterus to the back of the bladder, and forms between

those viscera the vesico-uterine pouch. And finally it covers all the posterior surface of the bladder included between the two obliterated hypogastric arteries, *c.*

The *recto-uterine pouch*, N, of the peritoneum resembles the rectovesical in the male. Below it reaches beyond the uterus and touches the back of the vagina. On each side, as in the male, are the visceral arteries and the ureter, invested by the serous membrane.

The *vesico-uterine pouch*, O, intervenes between the bladder and the uterus, and extends downwards usually only two-thirds of the anterior surface of the womb, but in the body from which the Figure was taken it was prolonged (as behind) as far as the tube of the vagina, with which it was in contact.

Appendages of the uterus. These are inclosed in the broad ligament, and are three in number on each side, viz. Fallopian tube, round ligament, and ovary and its ligament.

The *Fallopian tube*, G, lies along the upper free edge of the broad fold of the peritoneum, and is about four inches in length. By the inner end it is attached to the body of the uterus, and at the outer it terminates in a free dilated extremity—the infundibulum or pavilion. Between the extremities it has a curved condition with the convexity up; and it is small and round near the uterus, but gradually enlarges towards the outer or trumpet-shaped end. It is a hollow tube; internally it communicates with the cavity of the uterus, and externally by a small aperture with the sac of the peritoneum.

The outer end is provided with points or fringes called *fimbriae*, and with folds of the mucous membrane within. Some of these are larger than the others; and in the bottom of the dilatation is the aperture of the tube surrounded by the folds.

Its office is to convey the ovum from the ovary to the uterus; and a muscular layer, continuous with that in the wall of the uterus, enters into its structure.

The *round* or *suspensory ligament* of the uterus, E, is contained in the fore part of the broad ligament, near the top, and is inserted into the uterus close below and before the Fallopian tube. About five inches in length, it is directed outwards from the cavity of the belly through the internal abdominal ring and the inguinal canal to the groin, where it blends with the subdermic areolar tissue. In the abdominal cavity it is *invested* by the peritoneum; and in the inguinal canal it is accompanied

for a short distance by a process of that membrane, which is sometimes pervious to a small extent.

This band consists of fibrous tissue, and of muscular fibres continuous with those of the uterus; and its office is to assist in supporting the womb.

The *ovary*, F, is an ovalish body, something like the testicle in form, which is situate at the back of the broad uterine fold of the peritoneum, and below the other two appendages.

It is whitish in color, with more or less of an irregular surface; and it measures about an inch and a half in length in the child-bearing period of life. Its position is horizontal, with the ends directed inwards and outwards: it is attached to the uterus internally by a special fibrous band—ligament of the ovary, Q; and externally it is connected by one of the fimbriæ to the trumpet-shaped mouth of the Fallopian tube.

This body contains a spongy substance surrounded by a dense fibrous coat; and the whole is invested by the serous membrane. There is not any excretory canal attached to it, for the Fallopian tube discharges the office of conveyer of its generative products.

In the ovary the ova are produced; and when these small bodies are matured they burst through the external coats, and are received into the pavilion of the Fallopian tube, which grasps the ovary at the time of their escape.

The *Ligament of the ovary*, Q, is a narrow fibrous band uniting the inner end of the ovary with the body of the uterus: it lies below the Fallopian tube in the broad ligament.

VISCERAL ARTERIES OF THE PELVIS.

The viscera common to both sexes receive similar arteries, and those peculiar to each sex have special vessels.

- | | |
|--------------------------------|-----------------------------------|
| a. External iliac artery, cut. | i. Branches to rectum. |
| b. Internal iliac artery. | j. Ending of pudic artery. |
| c. Obliterated hypogastric. | k. Gluteal artery, cut. |
| d. Upper vesical artery. | l. Ovarian artery. |
| e. Lower vesical artery. | n. Branch of ovarian to uterus. |
| f. Uterine artery. | o. } Branches of upper hæmorrhoi- |
| g. Middle hæmorrhoidal. | q. } dal artery. |
| h. Vaginal artery. | p. } |

Internal iliac artery, b. This large trunk furnishes visceral and parietal branches in the pelvis, as before said, p. 67; but only the arteries to the viscera are delineated in this Plate.

Common visceral branches. The arteries which have the same name and general distribution in the male and female are the vesical and hæmorrhoidal.

The *vesical* arteries, two in number, upper, *d*, and lower, *c*, are distributed to the regions of the bladder indicated by their names.

The *middle hæmorrhoidal* artery, *g*, ramifies in the wall of the rectum, below the recto-uterine pouch of the peritoneum: part of it has been cut off.

The *upper hæmorrhoidal* is derived from the aorta in both sexes, and its distribution is referred to in page 88. Three of its branches, *o*, *p*, *q*, are shown on the lower part of the rectum, coursing down to pierce the muscular coat, and end in loops within it.

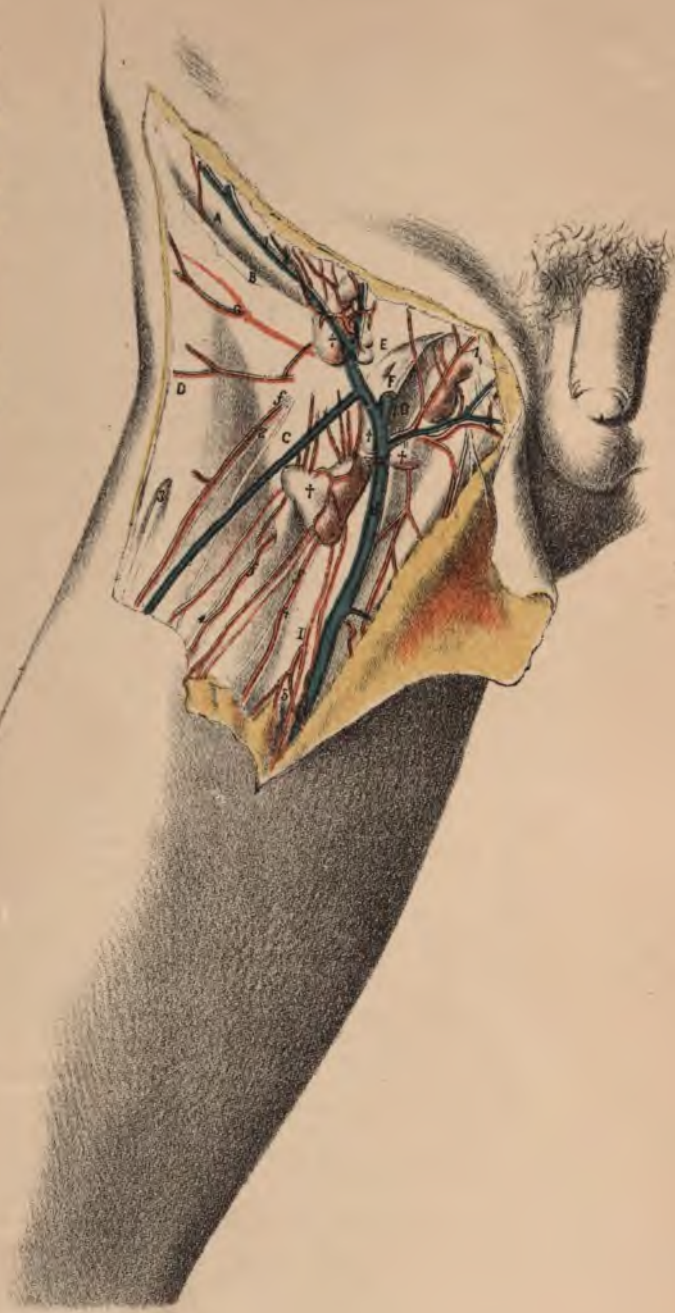
Special visceral branches. Three arteries are furnished to the generative organs of the female, viz., the uterine, the vaginal, and the ovarian, but only the two first are branches of the internal iliac.

The *uterine artery, f*, is the largest visceral branch of the iliac trunk, and is remarkable in being very tortuous on the womb. At first it is directed forwards beneath the peritoneum to the neck of the uterus; at this spot it ascends along the side to the fundus of that viscus, where it ends. Many large serpentine branches are distributed from it to the uterus, and it communicates above with the ovarian artery. Near the cervix uteri it gives some branches to the upper part of the vagina.

The *vaginal artery, h*, courses forwards between the vagina and the rectum to the lower end of the vagina, where it terminates in small branches: it furnishes many offsets to both tubes.

The *ovarian artery, l*, corresponds with the spermatic artery of the male, and is, like this, a branch of the abdominal aorta. Arising from the great systemic vessel near the renal artery, it enters the pelvis by the side of the internal iliac, and is then continued onwards across that cavity to the ovary. This artery is flexuous, like the uterine.

At the ovary it divides into branches, which enter that body. One offset, *n*, runs in the broad ligament to the upper part of the uterus, and communicates with the uterine artery; and other branches are continued between the layers of the broad fold of peritoneum to the Fallopian tube and the round ligament.



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Nerves of the pelvis. The nerves of the muscles have been omitted in this view of the female pelvis; and the visceral nerves of the sympathetic have been taken away, as in the dissection of the male pelvis, because they would obscure the view of the viscera.

- | | |
|--|--|
| 1. Nerves in the sacral plexus, cut.
2. Lateral part of the hypogastric plexus. | 3, 3. Parts of the pelvic plexus, cut through. |
|--|--|

The *pelvic plexus* of the sympathetic nerve (p. 90) of which parts 3, 3, remain, resembles in its composition the like plexus of the male, and supplies the viscera. It is situated by the side of the vagina, bladder, and rectum; and it furnishes common branches to the bladder and rectum, like those of the male; and special branches to the uterus, Fallopian tube, and vagina.

An *ovarian plexus* of nerves accompanies the ovarian artery, and supplies the ovary and the uterus: this was taken away in the dissection.

ILLUSTRATIONS OF THE LOWER LIMB.

DESCRIPTION OF PLATE XLII.

THIS Figure shows the dissection of the superficial vessels, nerves and glands, as well as that of the fascia lata near Poupart's ligament.

The limb being abducted from its fellow, rotated out, and supported with the hip and knee in a semiflexed position, the skin and the subcutaneous fat were removed, whilst the vessels, nerves and glands contained in it were dissected out. The opening for the saphenous vein should then be carefully defined.

SUPERFICIAL VESSELS, NERVES AND GLANDS.

The cutaneous arteries and veins ramifying in the integuments of the top of the thigh are branches of the femoral trunks.

- | | |
|--|--|
| <p><i>a.</i> Superficial pudic artery.</p> <p><i>b.</i> Superficial epigastric artery.</p> <p><i>c.</i> Superficial circumflex iliac artery.</p> <p><i>d.</i> Saphenous vein.</p> <p><i>e.</i> Superficial pudic vein.</p> | <p><i>f.</i> Cutaneous arteries of the thigh.</p> <p><i>g.</i> Cutaneous vein of the front of the thigh.</p> <p><i>h.</i> Superficial epigastric vein.</p> <p><i>i.</i> Superficial circumflex iliac vein.</p> |
|--|--|

Arteries.—The cutaneous arteries in the groin, like the tegumentary vessels in other parts, are very irregular in their arrangement: their names are taken from their distribution.

The *superficial pudic* artery, *a*, pierces the deep fascia of the limb about the mid-line; or it may come through the saphenous opening, as in the Figure; having entered the fat, it courses upwards and inwards to end in the integuments of the pubes, penis, and scrotum. See also Plate xxxii.

A second superficial pudic artery, which lies at first beneath the fascia lata, is delineated in Plate XLV., and will be referred to with the anatomy of the femoral artery.

The *superficial epigastric* artery, *b*, appears through the fascia near Poupart's ligament, being sometimes united with the preceding small artery, and ascends in the fat of the belly towards the umbilicus.

The *superficial circumflex iliac* artery, *c*, runs outwards at first beneath the fascia lata, and pierces that membrane towards the outer border of the thigh, to end in the integuments. Two or three offsets enter the fat at intervals; and some accompany the genito-crural and external cutaneous nerves.

Other unnamed small arteries, which accompany the nerves, 4 and 5, and are marked with, *f*, are derived from the femoral trunk lower down in the thigh.

Superficial veins. The companion veins of the superficial arteries above described end for the most part in the saphenous vein.

Internal saphenous vein, d. This large cutaneous vein reaches from the dorsum of the foot to the groin, but only the upper part is laid bare in the dissection. As now seen, the vein ascends, internal to the mid-line of the thigh, to about an inch and a half from Poupart's ligament, where it sinks through an opening in the fascia lata to enter the femoral trunk. Near its ending it receives the superficial pudic, *e*; the epigastric, *h*; and the circumflex iliac vein, *l*. Somewhat lower down in the thigh it is joined usually by two larger branches;—one, *g*, formed by the veins from the outer surface and front of the thigh, and the other by veins from the inner and hinder parts of the limb.

Superficial inguinal glands. These glands in the thigh are placed on the sides of the saphenous vein, and are superficial to the fascia lata. Of a flattened form and reddish color, they vary much in size and number: in this body they were rather large, and not numerous. They receive the afferent superficial lymphatics from the inner and fore parts of the limb; and transmit efferent vessels through the deep fascia to communicate with deeper lymphatics. Irritation of the surface of the foot, or of the inner part of the leg and thigh, along the course of the saphenous vein, may give rise to swelling and suppuration in this set of glands.

Another group of superficial inguinal glands lies transversely along the line of Poupart's ligament. See Plate xxxii.

Cutaneous nerves. The nerves now laid bare are derived from the lumbar plexus (p. 69); and they will be followed farther in the subsequent dissection of the thigh, with the exception of the ilio-inguinal.

- | | |
|------------------------------------|-------------------------------------|
| 1. Ilio-inguinal. | 4. Middle cutaneous of the thigh. |
| 2. Crural branch of genito-crural. | 5. Branch of the internal cutaneous |
| 3. External cutaneous. | of the thigh. |

The *ilio-inguinal* nerve, 1, issues through the external abdominal ring, and terminates in offsets to the scrotum, and to the integuments of the thigh internal to, and rather below the saphenous opening.

FASCIA LATA AND THE SAPHENOUS OPENING.

The special fascia of the thigh, or the fascia lata, gives a sheath to the limb, and serves for the attachment of muscular fibres at certain points: it is pierced also by apertures for vessels and nerves.

A.	Poupart's ligament.	G.	Inner sharp edge of the saphenous opening.
B.	Fascia of Scarpa, cut.	H.	Saphenous opening.
C. D.	Fascia lata.	I.	Opaque line of the bloodvessels under the fascia.
E.	Falciform edge of the saphenous opening.	††	Superficial inguinal glands.
F.	Inner part of the crural sheath.		

The *fascia lata*, C, forms a continuous tube around the thigh, and sends inward processes to form sheaths for the muscles. White lines on the surface indicate the position of the intermuscular septa. Along the front of the thigh is a wider yellowish line, I, which marks the situation of the subjacent femoral vessels.

Only a small part of the fascia is now laid bare, and through it the saphenous vein passes. Outside the opening for the vein the fascia is united above to Poupart's ligament: here it is thick and strong, and serves to keep the ligament tense and closely applied to the parts beneath, so that it assists materially in checking the descent of a piece of intestine beneath that tendinous band. Inside the opening the fascia is much thinner, and is inserted into the pubes.

Most of the apertures in the fascia for the passage of the superficial vessels and nerves are small, but that for the saphenous vein is large, and is called the saphenous opening.

The *saphenous opening*, H, is placed inside the line, I, of the femoral vessels, and is much larger than is needful for the passage of the vein and some other small vessels. Its form is semilunar, with the extremities directed up and down. Its measurements are, one inch and a half to two inches in length, and about half an inch across at the widest part; but the greater width in the Figure is due to the fascia being raised by the distending with injection the subjacent vessels.

The extremities of the aperture are named cornua: the upper cornu touches Poupart's ligament, and the lower is distant about one inch and a half from that structure.

The edges have different characters:—The outer is crescentic in form, and blends with the subjacent crural sheath F: above, where it is thicker and firmer, it unites with Gimbernat's ligament (part of the insertion of Poupart). To this border, which is not free, though it has a semilunar appearance, the term *falciform process* or *edge* has been given; and the upper part, between E and Poupart's ligament A, has been called by some

the femoral ligament. At the inner side of the opening the fascia lata is flattened half the way down over the subjacent pectineus muscle; but thence to the lower cornu it presents a sharp edge, G, which is continued below into the falciform part of the outer boundary.

In the area of the opening appears the loose membranous crural sheath F. To the sides of the aperture the deeper stratum of the subcutaneous or superficial fatty layer is connected by bands of fibrous tissue; and as that part, stretching over the opening, is pierced by many small apertures for lymphatics and vessels, it has been named the *cribriform fascia*.

Through this large aperture pass the saphenous vein, lymphatics, and one or more small superficial vessels: the vein enters nearer the lower than the upper cornu, but the others have not a fixed position.

By means of this aperture a femoral hernia comes forwards, and forms a swelling in the thigh; and as the saphenous opening serves as the aperture of exit of the hernia from beneath the fascia, it answers to the external abdominal ring of the inguinal hernia. The intestine escapes through the upper part of the opening above the situation of the vein, and pushes before it, while protruding, the crural sheath in which it descends, and the thin cribriform fascia placed over that hole. As the hernial tumor enlarges it is directed upwards upon the firm outer margin of the opening—the part above E; and since the gut makes a sharp curve round the fascia it may be constricted at that spot by the thickened falciform process.

The condition of the margins of the aperture as to tightness and looseness depends upon the position of the limb, and on the tension of the rest of the fascia lata. When the thigh is bent and rotated in, the margins of the saphenous opening are rendered lax; but if the thigh is extended and rotated out, the aperture is made tighter and smaller, and the outer edge takes on the characters of a firm constricting band. In an attempt therefore to force backwards a piece of protruded intestine into the abdomen the position of the limb should be specially attended to, for success may depend upon the greatest possible laxity being given to the edges of the saphenous opening.

DESCRIPTION OF PLATE XLIII.

IN this Plate the anatomy of the crural sheath and the course of a femoral hernia may be studied.

To display the crural sheath and its vessels, throw down a triangular flap of the fascia lata. The fat coming into view after the fascia lata is raised should be removed carefully; and the crural sheath should be detached with the handle of the scalpel from Poupart's ligament before, and from a deep piece of the fascia lata beneath it. Cut then transversely through the front of the crural sheath as is shown in the Figure; and remove a piece of the areolar sheath around the artery and the vein, so as partly to denude those vessels.

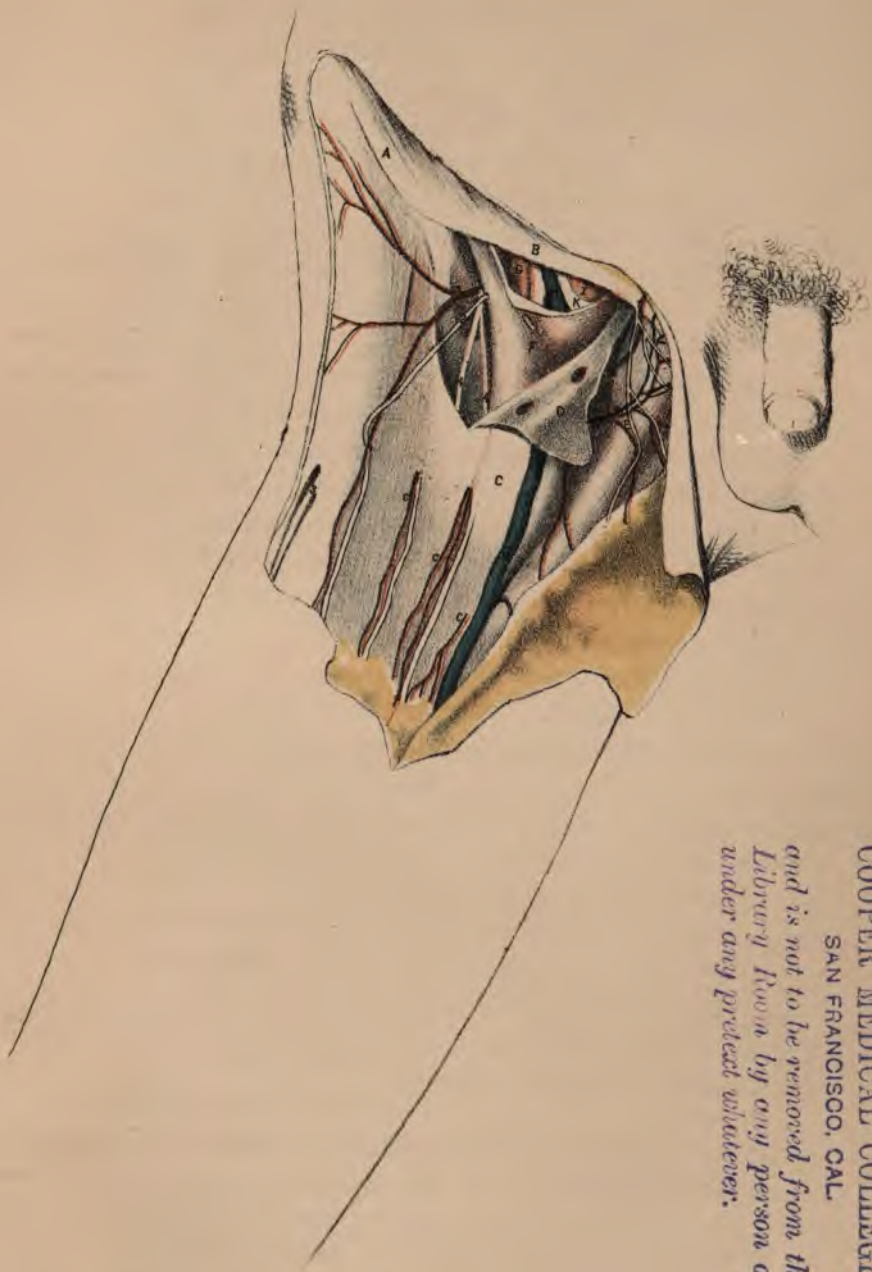
ANATOMY OF FEMORAL HERNIA.

As the femoral hernia descends into the thigh it passes beneath Poupart's ligament, and inside the loose crural sheath to the saphenous opening. The anatomy of those parts in the thigh will be described shortly before the hernia is referred to.

- | | |
|--|---------------------------------------|
| A. Oblique part of Poupart's ligament. | F. Crural sheath. |
| B. Horizontal part of the ligament. | G. Femoral artery. |
| C. Fascia lata of the thigh. | H. Femoral vein. |
| D. Reflected part of the fascia. | I. Inguinal gland in the crural ring. |
| E. Pubic part of the fascia. | K. Crural canal. |

Poupart's ligament separates the regions of the thigh and abdomen, and has been described in page 30. From its being attached to bone only at the extremities, and arching over the part issuing from the abdomen to the thigh, it has received also the name crural arch.

Between its terminal attachments the band is curved downwards to the thigh, being oblique in direction externally, and almost horizontal internally. To the lower border the fascia lata is attached; and as long



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As this membrane is entire the band is kept arched, but as soon as the fascia has been cut through the ligament becomes lax, and rises towards the abdomen. The space included between the ligament and the hip-bone is closed at the outer end by the large flexor muscles of the hip (psoas and iliacus), and at the inner by the femoral vessels and the crural sheath; the fasciæ too lining the cavity of the belly assist in closing the interval (Plate xxxv.). Between the ligament and the muscles there is not space for the escape of the intestine from the abdomen, but there is room for its passage in the crural sheath.

Poupart's ligament is rendered more or less resisting by the position of the limb. For instance if the limb is straight, as in standing, the crural arch is tense; and if the thigh is rotated out at the same time, that band is made as tight as it can be. When the thigh is bent on the abdomen the tendinous cord is relaxed; and it attains its greatest degree of looseness if the limb is rotated in at the same time. Of necessity this tendinous arch may act as a constricting band to a piece of intestine descending beneath it in femoral hernia.

Deep crural arch. A thin fibrous band across the front of the crural sheath has received this name. It begins about the middle of the superficial crural arch, and widening internally is attached to the pectineal line of the pubes; it consists mostly of a thickening of the membrane forming the fore part of the sheath.

The *crural sheath*, F, is a loose membranous tube around the femoral vessels, and is derived from the fasciæ lining the cavity of the belly. It lies under the inner or horizontal part of the crural arch, filling the interval not occupied by muscle; and it extends downwards about two inches before it blends with the areolar sheath around the bloodvessels. Upwards, or towards the abdomen, the fore part of the tube may be traced into the fascia transversalis; and the hinder part is described as being continuous with the fascia iliaca (Plate xxxv.).

Flattened from before back, it is triangular in form, with the base towards Poupart's ligament and the apex around the femoral vessels. Its outer edge is straighter than the inner. This funnel-shaped tube lies in an interval between two pieces of the fascia lata; in front of it is the reflected part, D, and behind it is a deeper piece of the same fascia, from both which it can be detached with the handle of the scalpel. Perforating it are superficial vessels for the top of the thigh, and the genito-crural nerve.

This tube serves as a casing to the bloodvessels passing from the abdomen to the thigh, and corresponds with a similar sheath on the vessels of the upper limb entering the axilla.

Interior of the crural sheath. On cutting through the front of the crural sheath, as in the Figure, the included space will be seen to be larger than is needed to lodge the femoral vessels; and to be largest internally where the tube slants most.

In the tube are contained the femoral vessels, each invested with a sheath of areolar tissue, together with an inguinal gland. The vessels lie side by side, the artery being external and near to the outer border of the tube; they are united together closely by their areolar investments. When a piece has been cut out of each areolar sheath, as in the Plate, the cut edges on the sides of the vessels will appear like partitions passing from the front to the back, and dividing into parts the contained space. Commonly three such spaces or compartments are described as resulting from two septa in the interior of the crural sheath, viz. an external containing the femoral artery; a middle one, the femoral vein; and an inner space, K, which is partly filled by an inguinal gland.

Through the inner space of the crural sheath a piece of intestine descends in femoral hernia; and names have been given to parts of the passage through which it glides, which resemble the terms applied to parts of the passage for the inguinal hernia. Thus the opening into the crural sheath from the cavity of the belly is the crural ring; the space in the interior of the sheath, inside the vein, is the crural canal; and the saphenous opening in the fascia lata represents the aperture of exit.

The *crural ring*, or the abdominal aperture into the space in the crural sheath, is placed on the inner side of the femoral vessels, and is on a level with the crural arch. It is about as large as the tip of the fore finger, and measures most from within out: it is closed by the inguinal gland, I, which lies in it, and by the sub-peritoneal fat (*septum crurale*) and the peritoneum which stretch across it above the gland.

Its bounding parts, and the vessels around, are described at page 50. (Plate xxxv.)

The *crural canal*, K, is the narrow space inside the crural sheath, which is internal to the femoral vein. It extends from the crural ring to the upper cornu of the saphenous opening, and measures from half to three quarters of an inch in length. It gradually tapers from above downwards, being pyramidal in form with the base upwards.

Contained in the crural sheath, it will be bounded externally to that tube, both in front and behind by fascia lata; and it is closed below by the meeting of the femoral vein with the inner slanting side of the crural sheath.

The *saphenous opening* is concealed by the reflected piece of the fascia lata; but it is delineated in Figure XLII. Its boundaries, size, and conditions, have been described in page 100. By means of this aperture the gut comes forwards to the surface of the thigh; and this aperture of exit has been called the lower opening of the crural passage.

Course of femoral hernia. The piece of intestine in femoral hernia passes beneath the crural arch and within the crural sheath as before said, but it changes its direction as it proceeds onwards. Entering the crural canal through the abdominal aperture, it descends vertically as far as the upper cornu of the saphenous opening. Next it advances through that opening to the surface of the thigh, making at first a small round tumor, but as more of the gut is protruded it extends transversely below Poupart's ligament. Finally, as the hernia enlarges it ascends over the crural arch on to the abdomen, because there is less resistance in this direction than towards the thigh. In consequence of the winding course of the intestine the last or ascending part comes to be parallel almost to the first or descending part of the tumor; and the two are united below by a curve around the sharp margin of the saphenous opening. In attempts to reduce a large femoral hernia the bend in the course is to be specially remembered, and the contents of the constricted gut are to be directed down and back to the upper part of the saphenous opening.

Whilst the intestine remains in the crural canal the hernia is said to be incomplete; but if the gut has escaped from the canal, and forms a tumor on the surface, the hernia is called complete.

Coverings of the hernia. The investments applied to the intestine as it descends are derived partly from strata in the abdomen, and partly from structures in the thigh. In the first place the gut receives a sheath from the peritoneum, which forms the sac of the hernia. In the next place it pushes onwards and elongates the layer of subperitoneal fat (septum crurale) as it enters the crural ring; and it causes the inguinal gland to be pushed aside or absorbed. With those two strata derived from the abdomen it traverses the crural canal as far as the saphenous opening; and at that point it will obtain the next two coverings, viz.

those of the crural sheath and the cribriform fascia, though it may burst through one or both of these. And lastly it stretches and forms coverings for itself of the subcutaneous fatty layer and the skin.

Six layers are thus enumerated as the coverings of a complete femoral hernia. In a recent tumor the several strata may be separated from each other; but in an older large hernia the coverings derived from the septum crurale and the crural sheath are conjoined, and form the fascia propria of Cooper. During an operation the surgeon may be able to recognize only four, viz. the skin and the subcutaneous fatty layer, the fatty subperitoneal covering, and the peritoneal sac.

Diagnosis. The tumor of a complete femoral is generally smaller than that of an inguinal hernia; and its deeper part or neck can be traced down to the hollow at the upper and inner part of the thigh, that is, to the upper cornu of the saphenous opening. Should it be larger in size, it extends transversely along the line of Poupart's ligament, instead of descending towards the scrotum as in the inguinal hernia. It can be distinguished with certainty from the inguinal hernia by the position of its neck beneath the crural arch; and if the finger can detect the cord of Poupart's ligament passing over the neck of the tumor there cannot be any doubt of the hernia being femoral.

Taxis and truss. Before attempts are made to replace the intestine in the cavity of the abdomen, the limb is to be raised and rotated in, and the shoulders are to be elevated at the same time, with the view of relaxing to the utmost the rigidity of the fibrous structures amongst which the intestine passes. Then pressure is to be made with one hand to the fundus of the tumor, whilst the first two fingers of the other are to be applied to the neck of the hernia to direct the contents of the intestine round the falciform edge of the saphenous opening, and upwards along the crural canal to the cavity of the abdomen. Whilst practising the manipulation the force employed is to be moderate but sustained. If the tumor has extended upwards on the abdomen it should be brought downwards towards the saphenous opening, in order that the bend around the falciform process of the fascia lata may be lessened.

After the hernia has been reduced its re-descent is to be stopped by a truss; but as the pad of this instrument cannot compress the internal crural ring, through which the intestine begins to descend, it is to be placed below Poupart's ligament, over the upper and inner part of the saphenous opening.

External stricture. The strangulation of the intestine will be produced generally by a constricting fibrous band across and outside the neck of the sac of the hernia. The seat of the constriction may be at the level of Poupart's ligament or of the saphenous opening, but both are near together, the spots being only about half an inch apart. In the former situation it is occasioned by the firm edge of the band formed by Gimbernat's ligament and the crural arch: and in the latter, by the sharp margin of the falciform part of the fascia lata.

This stricture may be relieved, without opening the sac of the hernia, by cutting down to the upper and inner part of the neck of the tumor, just below Poupart's ligament, and by incising all constricting bands external to the sac, whether at the saphenous opening or at Gimbernat's ligament. After the division of the external stricture, a slight degree of force will suffice to replace the intestine in the cavity of the abdomen.

Internal stricture. Stricture exists sometimes inside the sac of the hernia. In this case the constriction is produced, as in inguinal hernia (p. 41), by a thickening of the peritoneum of the neck of the sac, so as to form a band which diminishes the space in the interior, and impedes the passage both of the intestinal contents, and of the blood in the wall of the intestine. Its position is opposite the line of Gimbernat's ligament and the crural arch.

As the kind of strangulation cannot be determined beforehand, the coverings of the hernia are to be divided at the neck of the tumor, as in the case of the external stricture; and if the sac cannot be emptied of its contents after cutting through all constricting parts external to it, the intestine is to be relieved from internal stricture by opening the peritoneal sac, and, the knife being introduced on a director beneath the thickened band, by cutting horizontally inwards towards Gimbernat's ligament. In executing this last part of the operation the surgeon does not see what the knife cuts, and therefore he uses it sparingly, for as soon as the string-like band is divided the intestine becomes free to be passed into the abdomen.

In Plate xxxv. an inner view is given of the crural ring with the vessels around which may be endangered in an operation; and in page 52 are detailed the precautions to be taken in setting free the gut from internal stricture.

SUPERFICIAL VESSELS AND NERVES.

The cutaneous vessels and nerves which are figured in this Plate have been described in page 98; and they are marked for the most part with the same letters and figures of reference as in the preceding Plate. Consequently only their names will be given in the subjoined tables.

VESSELS.

- | | |
|--|-----------------------------|
| a. Superficial pudic artery. | d. Internal saphenous vein. |
| b. Superficial circumflex iliac artery. | e. Superficial pudic vein. |
| c. Cutaneous arteries of the front of the thigh. | |

NERVES.

- | | |
|------------------------------------|-------------------------------------|
| 1. Ilio-inguinal nerve. | 3. External cutaneous of the thigh. |
| 2. Crural branch of genito-crural. | 4. Middle cutaneous of the thigh. |

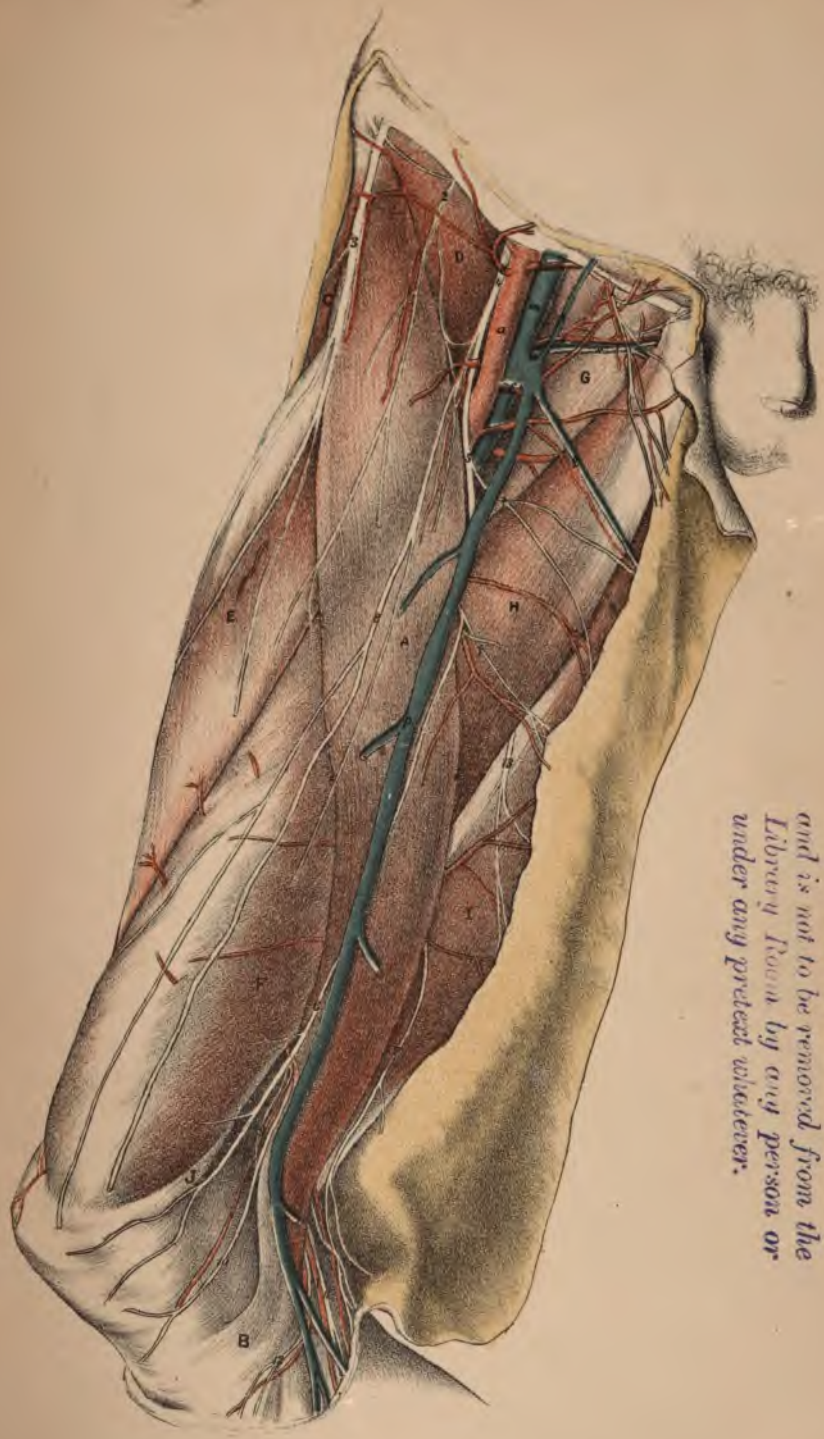
DESCRIPTION OF PLATE XLIV.

A SURFACE view of the muscles of the fore and inner parts of the thigh, with the cutaneous nerves placed in position after being dissected.

The common mode of proceeding with the dissection of the thigh has been here departed from, with the view of keeping within bounds the number of the Plates. Usually the subcutaneous nerves and vessels contained in the fat are first traced out. Scarpa's space at the top of the thigh is next laid bare, and the fascia lata is then removed to bring into view the muscles. If it is wished to study Scarpa's space separately from the rest, let the lower two-thirds of the Plate be covered with a piece of paper.

SUPERFICIAL NERVES AND VESSELS.

The cutaneous nerves of the front of the thigh are either direct offsets of the lumbar plexus, or are derived from branches of that plexus.



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- | | |
|--|---|
| <ol style="list-style-type: none"> 1. Ilio-inguinal nerve. 2. Crural branch of genito-crural. 3. External cutaneous. 4. Anterior crural trunk. 5. Internal cutaneous of the thigh. 6. Anterior branch of internal cutaneous. 7. Inner branch of internal cutaneous. | <ol style="list-style-type: none"> †† Offsets of internal cutaneous. 8. Middle cutaneous of the thigh. 9. Offset of internal cutaneous to the patellar branch of the saphenous. 10. Patellar branch of the saphenous. 11. Internal saphenous nerve. 12. Offset of saphenous to the leg. 13. Superficial part of the obturator. |
|--|---|

Ilio-inguinal nerve, 1. This small branch of the lumbar plexus has been noticed in page 70; and it has been delineated in the preceding Plates.

Genito-crural nerve. The crural part, 2, of this nerve issues beneath Poupart's ligament at the spot here indicated, when it is larger than usual; but commonly it lies nearer to the femoral vessels, as shown in Plate XLIII., where it is seen to perforate the crural sheath. It comes through the fascia lata near Poupart's ligament, and ramifies in the fat about half way down the thigh. Before or after it pierces the fascia it joins the middle cutaneous nerve, 8; and in the body used for the dissection, a junction took place under the fascia lata with the external cutaneous nerve, 3.

The *external cutaneous nerve*, 3, leaves the abdomen beneath the outer end of Poupart's ligament, and becomes subcutaneous about four inches from that band. It extends in the fat as low as the knee, and supplies branches to the outer and hinder parts of the thigh, behind a line drawn from the front of the iliac crest to the outer edge of the patella. One or two small branches pierce the fascia lata at a point higher than the trunk of the nerve.

Anterior crural nerve, 4. This large trunk of the lumbar plexus (p. 70) passes from the abdomen below Poupart's ligament; and, lying outside the crural sheath, divides into cutaneous and muscular branches. The superficial branches are the three following, viz. the internal and middle cutaneous, and the internal saphenous. The muscular branches are shown in Plate XLVI.

The *middle cutaneous of the thigh*, 8, enters the fat about three inches from Poupart's ligament: it extends to the knee along the centre of the thigh, distributing offsets laterally, and ends in the integuments over the

patella. Most commonly the nerve is subdivided into two; or there may be two distinct nerves.

Internal cutaneous of the thigh, 5. Springing from the anterior crural with the preceding, it descends beneath the fascia lata and along the edge of the sartorius, or under the muscle, as far as the junction of the upper and middle thirds of the thigh, where it divides into two parts, which are distributed as below:—

The anterior branch, 6, winds forward over the sartorius, A, and piercing the fascia lata in the lower third of the thigh, supplies the integuments as low as the inner side of the knee: it joins the patellar branch of the great saphenous nerve by the offset, 9.

The inner branch, 7, courses under, and along the hinder border of the sartorius to the inner side of the knee, where it is transmitted through the fascia lata; when cutaneous it is continued in the fat along the inner part of the calf of the leg, about half-way down. Near its beginning it is joined by a branch, 13, of the obturator nerve, and on the inner part of the knee there is a uniting branch, 9, between it and the great saphenous nerve.

From the trunk of the nerve before it divides, or from its anterior branch, offsets marked thus, †, are furnished to the integuments of the inner part of the thigh in the upper half.

The *internal saphenous nerve*, 11, lying at first beneath the sartorius, as is seen in Plate XLV., escapes from beneath that muscle at the inner side of the knee; and is continued with the vein of the same name through the leg to the foot. As it becomes cutaneous it gives forwards one offset to the integuments of the front of the leg, and another backwards to join the inner branch, 7, of the internal cutaneous.

Whilst the saphenous nerve is covered by the sartorius in the lower third of the thigh it supplies a *patellar branch*, 10, to the integuments of the inner and fore parts of the knee: this pierces the sartorius and the fascia, and being joined by an offset, 9, of the internal cutaneous, communicates in the fat with the middle and external cutaneous nerves, forming a plexus—the patellar.

Part of the obturator nerve. The superficial part, 13, of the obturator nerve comes forwards beneath the abductor longus muscle, H, and is inclined outwards under the sartorius muscle and the fascia lata to the femoral artery (Plate XLV.). It communicates with the internal cutaneous branch, 7, beneath the fascia; and some small offsets are pro-

longed through the fascia to the integuments on the inner side of the thigh.

Superficial vessels. Small arteries, for the most part unnamed; and the internal saphenous vein and its tributaries ramify in the fat of the thigh.

Cutaneous arteries. All the cutaneous nerves are accompanied by superficial arteries; but as these are small, and not so easily traced as the firmer nerves, they were not dissected farther than was necessary to give an idea of their main parts.

Ramifying with the ilio-inguinal nerve, 1, is a branch from the cremasteric artery; with the genito-crural nerve, 2, and external cutaneous, 3, are branches from the superficial circumflex iliac; with the middle cutaneous, 8, and internal cutaneous, 5, are small branches of the femoral trunk; with the saphenous nerve, 11, and with its branches, 10, and 22, are offsets of the anastomotic artery; and with the obturator nerve, 13, runs a small branch of the internal circumflex artery.

Other cutaneous arteries issue beneath the edges of the sartorius muscle, being furnished from the femoral trunk; and many small offsets, piercing the fleshy fibres of the vasti and rectus, come from the vessels to those muscles.

The *internal saphenous vein*, *p*, lies in the fat with the superficial nerves along the inner part of the thigh. Below, it passes the knee-joint on the inner side, behind the prominence of the inner condyle, and ascends obliquely to the level of the hip-joint, where it pierces the fascia lata to join the deep vein. See Plate XLII. Large unnamed branches join it about the knee, and smaller veins enter it in the thigh; and it receives near its ending the named veins accompanying the small superficial arteries of the groin.

SCARPA'S TRIANGULAR SPACE.

The triangular interval at the top of the thigh answers to the axilla in the upper limb. It is a rather shallow, intermuscular space, which is situate on the flexion-side of the hip joint, and contains the main vessels of the limb, with the nerve of the front of the thigh.

Its boundaries are the following:—The base, directed upwards to the abdomen, is limited by Poupart's ligament: in the dissected limb this

band forms a straight line, but before the removal of the fascia it arches down below the level of the arteries, *b*, and *c*, and diminishes the length of the space. The apex is formed by the meeting of the sartorius, *A*, and adductor longus, *H*, and points to the inner side of the mid-line of the thigh.

Towards the surface this space is closed by the strong fascia lata, and by the teguments and the inguinal glands: this covering will vary in thickness according to the quantity of fat in the body. The floor or the deep boundary is limited by the iliacus, *D*, and psoas, at the outer part; and at the inner part, by the pectineus, *G*, adductor longus, *H*, and still nearer the femoral vessels by a small piece of the adductor brevis.

The hollow is deepest near the middle, where the bloodvessels lie, and gradually becomes shallower from that point towards each side. It contains the femoral artery and vein, with their first branches, the anterior crural nerve, and lymphatics and fat.

The femoral artery, *a*, lies along the centre or deepest part of the intermuscular interval, resting above on the psoas muscle, and furnishing the large profunda and small superficial branches: it leaves the space below by sinking under the sartorius, about an inch outside the apex.

The femoral vein, *m*, lies close to, and on the inner side of the artery, gradually winding beneath that vessel near the sartorius muscle. Like the artery it is most superficial at Poupart's ligament; and at that spot it rests on the pubes, between the pectineus and psoas muscles. In the space it is joined by the saphenous or superficial, and by deep veins.

The anterior crural nerve, *4*, enters the space on the outer side of the artery, and may lie close to that vessel, as in the Plate, or at a short distance from it (quarter to half an inch). Above it lies deeply between the iliacus and psoas, and is separated from the artery by a slip of muscular fibres. About two inches from Poupart's ligament it breaks up into superficial and muscular branches; but before this final division it sends one or two small branches beneath the femoral vessels to the pectineus muscle.

Deep lymphatics lie around the femoral vessels, and receive superficial lymphatics near Poupart's ligament; upwards they are continued into the abdomen.

SURFACE MUSCLES OF THE FRONT OF THE THIGH.

Only one muscle—the sartorius, A, is completely laid bare in the surface view of the fore and inner parts of the thigh. Inside or above the sartorius are two groups of muscles, the flexors of the hip and adductors of the thigh; and outside the sartorius lies the extensor group of the knee. Altogether at the upper and outer part appears a small muscle (tensor vaginae femoris), which belongs to the abductor or gluteal set of muscles.

A. Sartorius muscle.
B. Tendon of the sartorius.
C. Tensor vaginae femoris.
D. Iliacus muscle.
E. Rectus femoris.
F. Vastus internus.

G. Pectineus muscle.
H. Adductor longus.
I. Gracilis muscle.
J. Tendon of adductor magnus.
X. Spot for ligature of the femoral artery.

The *sartorius*, A, is the longest muscle in the body. It crosses obliquely the thigh from the hip-bone on the outer side to the tibia on the inner, and lies in a hollow between the adductors of the thigh and extensors of the knee.

The muscle is narrow at the origin, and is attached to the upper iliac spinous process, and to half the notch between the two spinous processes. The fibres form a thin widened belly on the thigh, and end below in a short flat tendon, B, which is inserted into the inner surface of the tibia near the tubercle: from the upper border of the tendon one expansion is continued to the knee-joint capsule, and from the lower border another is prolonged to the fascia of the leg.

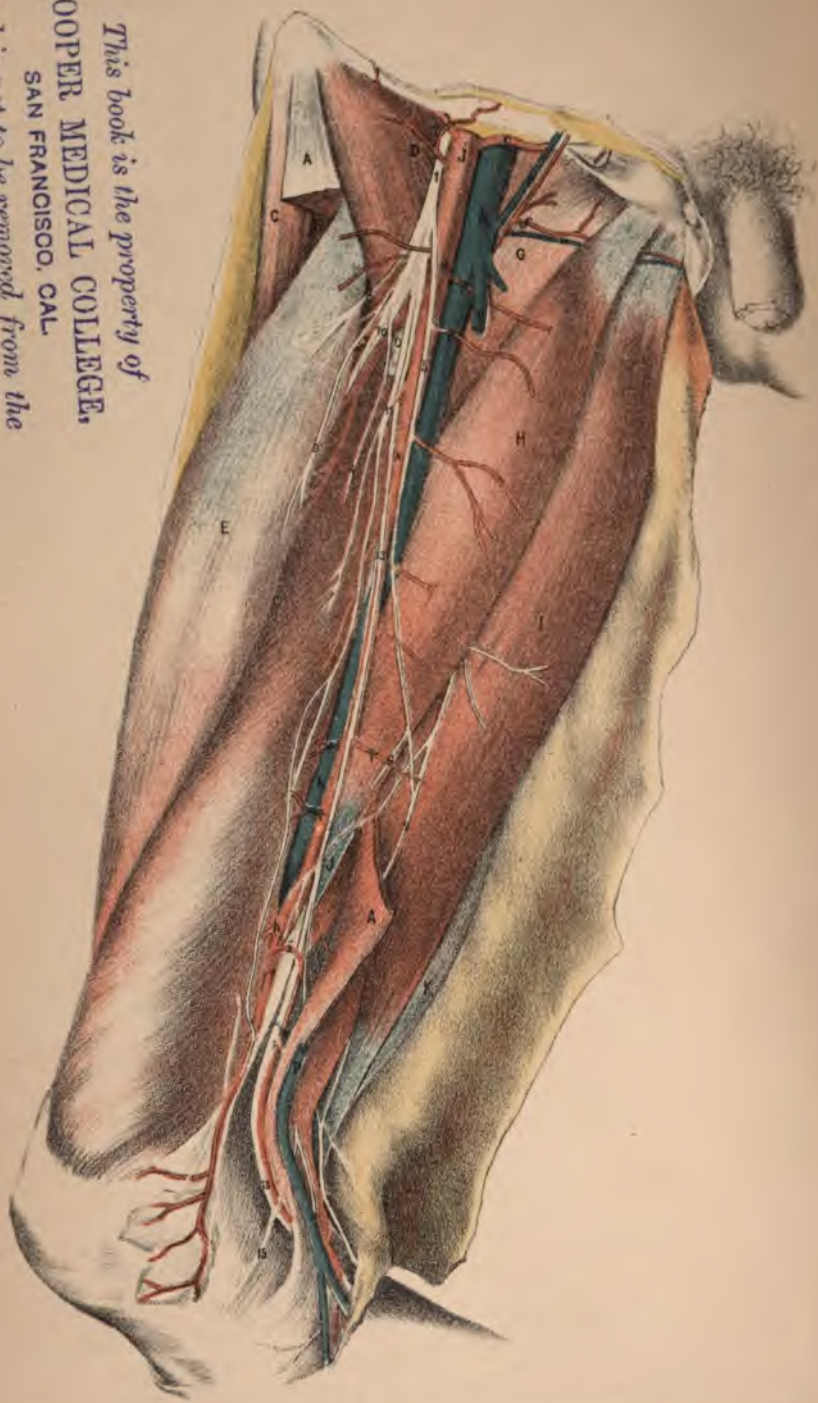
The sartorius conceals the greater part of the femoral vessels, and the branches of the anterior crural nerve. It rests on the following muscles:—along the inner edge, from above down, come the iliacus, D, pectineus, G, adductor longus, H, gracilis, I, and the inner hamstrings; and along the outer edge are the tensor vaginae femoris, C, rectus, E, vastus internus, F, and tendon of the adductor magnus, J. Just above the knee it bounds the popliteal space with the inner hamstrings; and this part is pierced by the patellar branch, 10, of the saphenous nerve.

The action of the muscle is exemplified in the posture of *squatting*. By its contraction the hip-bone is drawn forwards, the tibia backwards, and the fascia lata is rendered tense at the same time. If the pelvic end is fixed and the tibia free, the knee-joint will be bent; and if the tibial extremity becomes the fixed point the pelvis will be supported and drawn forwards. In standing on one leg, say the right, the muscle of the same side will assist in turning inwards the pelvis on the top of the femur, and in rotating the trunk to the left side: with the left muscle acting in the same way the trunk will be moved in the opposite direction.

Flexor muscles of the hip-joint. These are two in number, viz. the psoas and iliacus (p. 58); but only the latter, D, is now visible, as the psoas is concealed by the femoral artery. Both arise in the abdomen, and issue thence beneath Poupart's ligament to be inserted into, and in front of and below the small trochanter of the femur.

The *adductor muscles of the thigh* form the large fleshy mass at the inner side of the femur; they are five in number, but only three, viz. pectineus, G, adductor longus, H, and gracilis, I, are in contact with the fascia. All will be more completely laid bare in subsequent Plates; and in Figure XLVII. the deeper members of the group are exhibited.

The *extensors of the knee-joint* are three large muscles, which make the bulge on the fore part of the thigh: they consist of rectus femoris, E, vastus internus, F, and vastus externus (L, Plate XLVI.). Above, they are concealed for a short distance by the sartorius, A, and tensor vaginæ femoris, C; and below, they blend in a common tendon, which is continued over the knee-joint to the tibia. Plate XLVI. is specially devoted to the anatomy of these muscles, and of the vessels and nerves belonging to them.



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DESCRIPTION OF PLATE XLV.

THE anatomy of the femoral vessels and anterior crural nerve may be acquired from this Figure.

After the completion of the dissection for the preceding Plate the chief nerve and vessels on the front of the thigh will be brought into view by removing the cutaneous nerves, and by taking away the greater part of the sartorius muscle. On the removal of the fat and an aponeurosis beneath the sartorius the nerve and vessels will be visible.

SURFACE MUSCLES OF THE FRONT OF THE THIGH.

The connections of the several superficial muscles can be perceived in this Figure; but the description of each will be given subsequently with the group of muscles to which it belongs; they are marked by the same letters of reference as in Plate XLIV.

A. Ends of the sartorius.
B. Gluteus maximus.
C. Tensor vaginæ femoris.
D. Iliacus.
E. Rectus femoris.
F. Vastus internus.

G. Pectineus.
H. Adductor longus.
I. Gracilis.
J. Adductor magnus.
K. Semi-membranosus.

FEMORAL ARTERY AND VEIN.

The main bloodvessels of the lower limb, like those of the upper, are large single trunks as far as one bone reaches in the member, and divide into branches in the leg where two bones are present.

- | | |
|----------------------------------|---------------------------------------|
| a. Femoral artery. | i. Superficial branch of anastomotie. |
| * Spot for ligature. | † Cutaneous arteries of the femoral. |
| b. Circumflex iliac branch. | j. Ending of external iliac artery. |
| c. Epigastric branch. | k. Femoral vein. |
| d. Superficial circumflex iliac. | l. Superficial pudic vein. |
| e. Superficial pudic. | n. Deeper superficial pudic. |
| f. Deeper superficial pudic. | o. Profunda. |
| g. Profunda artery. | p. Saphenous vein, cut. |
| h. Anastomotie artery. | |

The *femoral artery*, *a*, is continuous directly with the external iliac, and reaches beyond the knee, like the brachial beyond the elbow, before it breaks up into secondary trunks. Its extent is marked in one direction by the lower border of Poupart's ligament, and in the other by the opening in the adductor magnus: finally it turns to the back of the limb, by this aperture, and obtains the name popliteal.

Its course in the limb is oblique; for near the pelvis the vessel lies over the hip-joint, whilst it is placed inside the femur below. And its position in the thigh would be marked by a line on the surface from midway between the symphysis pubis and iliac crest to the prominence of the inner condyle of the femur, when the knee is half bent, and the thigh bone rotated out. Pressure applied to the artery in the middle third of the thigh should therefore be directed outwards towards the femur; and when employed above, it must be made directly backwards against the hip-bone.

At the top of the thigh the vessel is near the surface and is uncovered by muscle, but in the rest of its extent it is concealed by the sartorius (see Plate XLIV.). In the description of its connections the artery will be divided into a superficial and a deep part.

The *superficial part* (Plate XLIV.) is contained in Scarpa's triangular space, and measures from three to four inches in length according to the width of the sartorius muscle. It lies nearly in the centre of the space, and its position in the limb may be ascertained by means of the upper part of the line before given for the course of the femoral trunk.

At first the artery is incased in the crural sheath with the femoral vein (Plate XLIII.). Between it and the surface of the limb lie the common teguments with inguinal glands, and the fascia lata. The vessel rests at first on the psoas muscle, and is placed lower down over the pectineus, *G*, but at some distance from it, the profunda and circumflex vessels with fat intervening.

To the inner side and close to the artery lies the femoral vein, which inclines gradually behind that vessel towards the apex of the space.

Outside the artery, either close to, or at a little distance from it, is the anterior crural nerve: this divides into many branches in the space of Scarpa; and of these, the internal cutaneous, 5, crosses over the artery near to or beneath the sartorius.

The *deep part* of the artery (Plate XLV.) is contained in an inter-muscular interval on the inner side of the femur, which has been called Hunter's canal. Superficial to the vessel in this hollow is the sartorius, A; with an aponeurotic layer beneath that muscle, which is stretched between the vastus internus, F, and the adductor longus and magnus muscles, H and J: this layer does not appear in the Figure, as it was removed in the dissection. Beneath the vessel lie the adductors, viz. pectineus, G (the lower end), adductor brevis (a small piece), adductor longus, H, and adductor magnus, J. On the outer side is the vastus internus, which separates the artery from the femur. Inferiorly the artery issues from that space through the aperture in the adductor magnus muscle.

The femoral vein is closely applied to the artery throughout, and winds behind it from the inner to the outer side. The superficial or internal saphenous vein has a position inside the bloodvessel, but often-times an external branch of that vein crosses the line of the artery (Plate XLII. g).

The internal saphenous nerve, 13, runs with the artery; it is outside that vessel above, but inside below, and crosses beneath the aponeurosis over the artery.

Position and size of the branches. Most of the unnamed branches of the femoral artery are small in size and cutaneous, and arise at tolerably regular intervals along the trunk. From the beginning come three small named branches (Plate XLII.), viz. superficial epigastric, *b*, circumflex iliac, *c*, and pudic, *a*. Two inches lower down arises the large profunda trunk, *g*, for the supply of the thigh. And close to the ending springs the small anastomotic artery, *h*, for the knee-joint.

Of these branches the profunda is the largest; and to it the term deep femoral has been given. It arises commonly from the second inch of the femoral trunk, varying much as to its site within that limit; but its origin takes often a much wider range as the observations of Mr. Quain

have demonstrated.* Thus it may be attached to the first inch of the femoral, or even higher, so as to come from the end of the external iliac. Or it may leave the parent vessel lower in the thigh, arising as far as four inches from Poupart's ligament; but in this state of deviation its circumflex branches are usually attached higher up and separately to the femoral trunk. As the beginning of this large vessel ranges then over the upper four inches of the femoral artery a ligature cannot be applied to that part of the vessel without the prospect of subsequent hæmorrhage.

Ligature of the femoral. As this vessel, like the artery of the upper limb, is conveniently placed for the employment of pressure to control the circulation of the blood, the operation of tying it with a thread for the treatment of aneurism in the popliteal space will be resorted to but rarely; but should such a proceeding be required the following directions may be useful in its execution.

The spot chosen for ligature is determined by the place of origin of the profunda, as the surgeon desires to place the thread on the femoral trunk beyond that large nutritive and anastomic branch. But as the origin of the profunda wanders over the highest four inches of the femoral artery, a spot between four and five inches from Poupart's ligament, which is marked thus, X, in the figure, is to be selected as the most suitable for that operation, even though the vessel is not so accessible as it would be in Scarpa's triangular space.

The position of the femoral artery in the limb may be ascertained by a line on the surface from the mid point between the iliac crest and the symphysis pubis to the inner condyle of the femur, the hip and knee-joints being slightly bent at the time, and the thigh rotated out. This line is to serve both as the superficial and the deep guide; and if it is not accurately taken and strictly kept some difficulty may be experienced in finding the artery, as there is not any deep part to direct the operator to the position of the bloodvessel.

In executing the steps of the operation the fore finger of the left hand is placed opposite the part of the vessel to be tied, and the knife incises the integuments for three inches, the centre of the cut being marked by the finger; and as there may be a large branch of the saphenous vein crossing the artery the knife should be used cautiously at this stage. The fascia lata should next be cut for the same extent as the skin and fat.

*In the work before referred to on the Surgical Anatomy of the Arteries.

Then the fibres of the sartorius, which are inclined downwards and inwards, will appear in the bottom of the wound. This muscle is next to be reflected with care from the artery, and to be drawn to the outer side of the wound; and underneath the spot occupied by the sartorius the femoral artery may be recognized during life by its pulsation, and in the dead body by its color.

The next step is to detach the artery from the surrounding parts. For this purpose seize the areolar sheath with a forceps, and open it with a part of the scalpel at some little distance from the point, avoiding if possible the internal cutaneous nerve. The sheath being still held in the forceps, separate the artery from this and the companion vein by a blunt instrument, such as a director, introduced through the opening in the areolar investment.

Raising the sheath with the forceps the operator introduces the aneurism needle between the artery and vein; and then elevating the opposite side of the sheath, he passes the instrument gently round the artery. Finally setting free the thread from the needle in the usual way, the surgeon ligatures the femoral trunk; but in the living body he ascertains beforehand that the vessel pulsates on compression with the finger. Gentleness and tact are required in passing the needle, lest the instrument should pierce either of the large bloodvessels; but if the aneurism needle is carried from right to left, puncture of either is less likely to happen than if it is moved in the opposite direction.

Should the artery be deprived of its sheath to a greater extent than is needed for the passage of the aneurism needle, it should be secured by two ligatures—one at each end of the denuded part.

On reaching the artery the operator may find the origin of the profunda at that point, or possibly, though but rarely, the femoral trunk split into two:—In each case he would include both vessels in ligatures.

Usually the femoral vein is not seen in the operation specified; but if it is split, or if one of its pieces crosses over the artery, it may be in the way of the knife in opening the sheath.

Branches of the femoral artery. The first three branches are small and cutaneous, and are named *superficial pudic*, *epigastric*, and *circumflex iliac*: these have been noticed with Plate XLII. Another superficial pudic branch is the following.

The *inferior* or deeper *superficial pudic* arises from the femoral trunk rather lower; it runs beneath the *lata* and the *gracilis* muscle to the

inner side of the thigh, where it ends in the teguments of the limb and scrotum, and in the labium pudendi of the female. Small collateral offsets are furnished to the muscles with which it is in contact.

The *profunda artery, g*, arises about an inch and a half below Poupart's ligament, and descends in the thigh beneath the femoral artery, as is shown in Plate XLVII. It supplies large nutrient and anastomotic branches to the thigh.

Cutaneous and muscular branches. The small arteries to the integuments which are marked thus, †, have been described in page 111. The muscular branches from the femoral trunk are but few: they enter the vastus internus, sartorius, and adductor longus.

The *anastomotic artery, h*, springs from the end of the femoral, and is continued between the vastus internus and the tendon of the adductor magnus to the inner side of the knee: here it ramifies under the aponeurotic investment of the joint, and anastomoses with the other articular arteries. Offsets are given by it to the vastus internus, one crossing the lower end of the femur above the joint.

A superficial branch of the anastomotic, *i*, accompanies the trunk of the saphenous nerve beneath the sartorius, and ends in the integuments with that nerve.

The *femoral vein, k*, is a companion to the artery, and has the same extent. Closely united throughout to the artery it changes its position to that vessel about the middle of the thigh, for it is on the inner side above, but on the outer side below. Near Poupart's ligament it is placed over the interval between the psoas and pectineus, but farther in the thigh it has connections with parts around like those of the artery.

Its branches are similar for the most part to those of the artery, but they have been taken away in the progress of the dissection. Near the top of the thigh it receives in addition the superficial or saphenous vein; and at the same place it is joined by the small vein, *n*, accompanying the deeper of the two superficial pudic arteries.

ANTERIOR CRURAL NERVE.

This large nerve of the lumbar plexus (p. 70) divides in Scarpa's triangular space into a superficial and a deep set of branches.

The *superficial set* consists of internal cutaneous, middle cutaneous,

and internal saphenous; but as the middle cutaneous has been noticed sufficiently with Plate XLIV. it will not be referred to again.

The *internal cutaneous nerve*, 5, inclines beneath the sartorius to the inner side of the thigh, and divides into two parts, anterior and inner.

The anterior part, 6, is delineated in Figure XLIV., and its description is given in page 110.

The inner part, 7, descends along the inner border of the sartorius nearly to the knee, where it becomes a cutaneous nerve of the leg (Plate XLIV.). Near its beginning it is joined by an offset from the obturator, 15; and lower down (occasionally) by a branch, 8, from the internal saphenous. See also p. 110.

The *internal saphenous nerve*, 13, courses beneath the sartorius, and at the insertion of that muscle becomes cutaneous below the knee: it is then continued through the leg to the foot. For two-thirds of its extent in the thigh it accompanies the femoral vessels, crossing over them from the outer to the inner side, and lying under the aponeurotic layer over them; but beyond the opening in the adductor magnus the superficial branch, *i*, of the anastomotic artery runs with it.

One or two branches are furnished by the nerve:—an occasional offset, 8, communicates with the internal cutaneous nerve; and a large patellar branch, 14, pierces the sartorius to ramify in the teguments over the knee (p. 110).

The *deep set of branches* of the anterior crural are furnished to muscles; they supply the extensors of the knee-joint, and the sartorius and pectineus.

The branch to the sartorius, 3, has been separated from its muscles; oftentimes an offset of the middle cutaneous enters the sartorius.

The nerve to the rectus, 9, has been cut through as it penetrates the muscular fibres.

The nerve of the vastus internus, 11, pierces the fleshy fibres about the middle of the thigh. As it is about to enter it gives a slender articular branch, 12, to the knee-joint, which runs on the surface of the vastus, covered at places by some fleshy fibres, and accompanies lower down the anastomotic artery to the joint. In this body a second articular branch issues from the fleshy fibres nearer the knee.

The nerve to the vastus externus, 10, will be described with the following Plate.

The nerves to the pectineus, 2, one or two in number, arise higher

than the rest, and cross beneath the femoral vessels to be distributed to the muscle: for their ending, see Plate XLVI.

Oblurator nerve, 15. A small part of this nerve is included in the dissection, but its distribution is visible in Plate XLVII., with which it will be described.

DESCRIPTION OF PLATE XLVI.

THIS Illustration shows the dissection of the deep muscles of the fore and outer parts of the thigh, with their vessels and nerves.

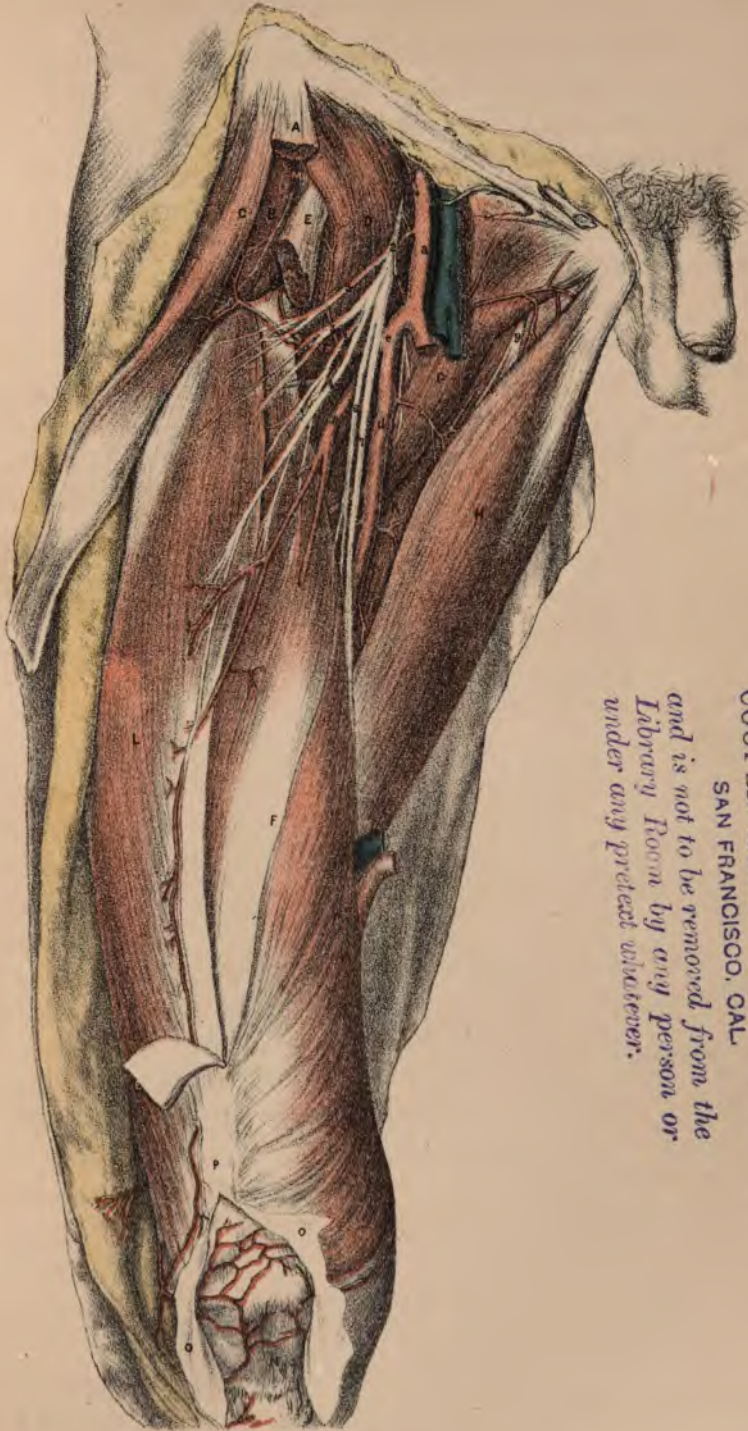
The thigh having been prepared for the drawing of the preceding Figure, the dissection for this Plate will be completed by cutting through the rectus muscle, and removing the fat from the branches of the external circumflex artery and anterior crural nerve. With the handle of the scalpel the outer vastus, L, may be separated above from the inner vastus, F, where vessels and nerves intervene; and the thin aponeurosis, O, which is continued from their common tendon over the knee-joint, may be cut through and raised to the sides of the knee. All the fascia lata on the outer part of the thigh is to be removed, except a narrow slip with the insertion of the tensor vaginæ femoris.

MUSCLES OF THE FRONT OF THE THIGH.

The chief fleshy mass on the front of the femur is formed by the three parts or heads of the extensor of the knee-joint; but at the upper and outer parts of the thigh are the small tensor vaginæ femoris, and the gluteal muscles.

A. Sartorius, cut.
 B. Gluteus medius.
 C. Tensor vaginæ femoris.
 D. Iliacus.
 E. Rectus femoris, cut.
 F. Vastus internus.
 G. Pectineus.
 H. Adductor longus.

K. Adductor brevis.
 L. Vastus externus.
 M. Gluteus minimus.
 N. Ligamentum patellæ.
 O. Expansion from the extensor tendon of the knee.
 P. Tendon of the extensor cruris.



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The *tensor vaginæ femoris*, C, is a small muscle, which is attached by one end to bone, and by the other to the fascia lata. It takes origin from the upper iliac spinous process, from the contiguous part of the iliac crest, and from half the notch between the two iliac spinous processes; reaching downwards at the outer side of the thigh, it is inserted into the fascia lata where the upper and middle thirds meet.

The muscle is incased in strong fascia, and is placed between the gluteus medius, B, behind, and the sartorius, A, and rectus, E, in front. Underneath it lies the upper part of the vastus externus, L, and the ascending branches, *f*, of the external circumflex artery. A small nerve, 1, and arterial offsets enter the under surface.

The muscle can abduct the thigh from the other limb, and make tense the fascia, deriving from this circumstance the name tensor of the fascia lata. After the thigh has been rotated out the muscle will act as an internal rotator of the femur.

The *extensor of the knee* (triceps extensor cruris) consists of three separate parts or heads, viz., rectus femoris, E, vastus internus, F, and vastus externus, L, which are united below in a common tendon.

Rectus femoris, E (Plate XLV.). This spindle-shaped muscle forms the middle or long head of the extensor. It arises from the hip-bone by two tendinous pieces:—one is attached to the anterior inferior iliac spinous process; and the other, longer and wider, is fixed to the depression above the acetabulum. Inferiorly the muscle becomes tendinous, and blends in a common tendon of insertion, P, with the other two heads of the extensor.

The rectus is superficial except above, where it is covered by the sartorius, the iliacus, D, and the gluteus minimus, M. It conceals branches of the external circumflex artery, *e*, and anterior crural nerve, 2. Some of the fleshy fibres run from a central tendon to the sides, like the feather of a quill; producing the arrangement called penniform.

The *vastus externus*, L, or outer head of the extensor, arises from the upper half of the femur by a piece from half an inch to an inch thick, which is limited behind by the following points of the bone, viz., the outer part of the neck, the root of the great trochanter, the line leading from the trochanter to the linea aspera, the upper half or more of the linea aspera; and it arises also from the contiguous external intermuscular septum.* For the most part tendinous above, it becomes fleshy

* The origin of the muscle here specified is that given by Cruveilhier and

lower down, and the fibres end inferiorly in the common tendon of insertion, some joining the rectus tendon and the patella.

The upper part of the muscle is overlaid by the rectus and tensor vaginæ femoris. Beneath this vastus lie the inner vastus in part, and branches of the external circumflex artery and anterior crural nerve. Its lower tendon occupies the under surface, and extends upwards along the anterior or free edge of the muscle.

The *vastus internus*, F, constitutes the inner or large head of the extensor. It arises from the shaft of the femur except at the *linea aspera* and on the surfaces behind included by the lines prolonged from that ridge of bone to the trochanters in one direction and the condyles in the other.* Necessarily the fibres cannot be fixed where the outer vastus takes origin; and they are absent from the ends of the femur, for they reach upwards only to the anterior intertrochanteric line, and cease below near the articular surface of the knee-joint.

Most of the fleshy fibres are received on the superficial aponeurosis, which unites with the other heads in the common tendon of insertion, whilst some superficial fibres terminate on the tendon of the rectus and on the patella.

The upper part of the muscle is deeply placed beneath the rectus and sartorius, and vessels and nerves (Plate XLV.). Along the inner side lie the flexors and adductors of the hip-joint and the large bloodvessels of the limb. Towards the knee the muscle becomes prominent and makes a larger surface-swelling than the vastus externus on the outer side.

Common tendon of the extensor, P. Above the joint it is formed by the union of the tendons of the three heads; and it is continued over the knee-joint, diminishing in width, to be inserted into the tubercle of the tibia, and into an inch of the bone below: between the prominence of the tubercle and the tendon is a small bursa. Contained in the tendon is the patella, N, which completely divides it into an upper and a lower part:—The upper wide part intervenes between the fleshy fibres and the base of

Theile, and is not so extensive as that assigned to it in English anatomical works: it resembles closely the attachment of the outer head of the triceps extensor brachii.

* This mass is described commonly as consisting of two muscles, vastus internus and crureus. Naturally there is not any separation between the two on the surface; and if a division is desired the mass is to be cut through longitudinally where the anterior and inner surfaces of the femur meet.

the patella; and the lower, narrower part, called oftentimes ligament of the patella, fixes the apex of that bone to the tibia. A very thin layer of tendinous fibres passes over the cutaneous surface of the patella.

An aponeurotic expansion, O, is prolonged from the upper part of the tendon over the patella and the knee-joint, and is fixed into the bones of the leg. On the knee it unites with the fascia lata, and with prolongations from the lateral flexors to form a capsule for the knee-joint.

Subcrureus. Under the extensor, on the lower fourth of the femur, lie some scattered fleshy fibres, arranged frequently in an outer and an inner fasciculus, which are inserted inferiorly into the synovial membrane of the knee-joint.

Action of the extensor. The use of the muscle will vary with the fixed or movable condition of the bones of the limb to which it is attached. If the tibia is free to be moved all three heads will advance this bone on the articular surfaces of the femur, and so extend the knee-joint. Should the tibia be immovable, as in rising from a stooping posture, or in walking, the femur and pelvis will be brought forwards over it. By the continued contraction of the muscles, after those bones are in a straight line, the body will be supported in standing by the action of the rectus on the pelvis, and of the two vasti on the femur.

The fibres of the subcrureus draw upwards the synovial membrane of the knee-joint as the tibia and femur come into a straight line in extension; and they are supposed to remove that membrane out of the way of pressure by the patella.

VESSELS OF THE FRONT OF THE THIGH.

The vessel supplying the extensor muscle of the knee is the external circumflex branch of the profunda artery, with its vein.

- | | |
|--------------------------------|------------------------------------|
| a. Femoral artery. | f. Ascending branch of circumflex. |
| b. Circumflex iliac artery. | g. Descending branch. |
| c. Epigastric artery. | h. Transverse branch. |
| d. Profunda artery. | i. Femoral vein. |
| e. External circumflex artery. | |

The *profunda artery*, d, runs beneath the femoral trunk, and distributes large branches in the thigh: of these the only one included in this Illustration is the external circumflex.

The *external circumflex artery, e*, is the largest branch of the profunda, and springs near the beginning of that trunk: destined for the outer part of the thigh, it divides into three chief pieces amongst the branches of the anterior crural nerve.

The ascending branch, *f*, passes under the sartorius, rectus, and tensor vaginæ femoris to the back of the hip-bone, where it supplies the gluteal muscles, and anastomoses with the gluteal artery: it furnishes nutritive branches to the muscles amongst which it passes.

The descending branch, *g*, is the largest of the three pieces, and divides into offsets which enter the deep heads of the extensor. One offset courses over the surface of the vastus externus to the knee-joint with a small nerve.

The transverse branch, *h*, divided into two or more offsets, enters beneath the vastus externus, and piercing that muscle anastomoses with the arteries on the back of the thigh.

The *external circumflex vein* (Plate XLV. *o*) has the same general distribution as the artery, and joins the profunda vein.

NERVES OF THE FRONT OF THE THIGH.

Two nerves, viz., a branch of the gluteal, and the anterior crural, are supplied to the muscles described in this Plate.

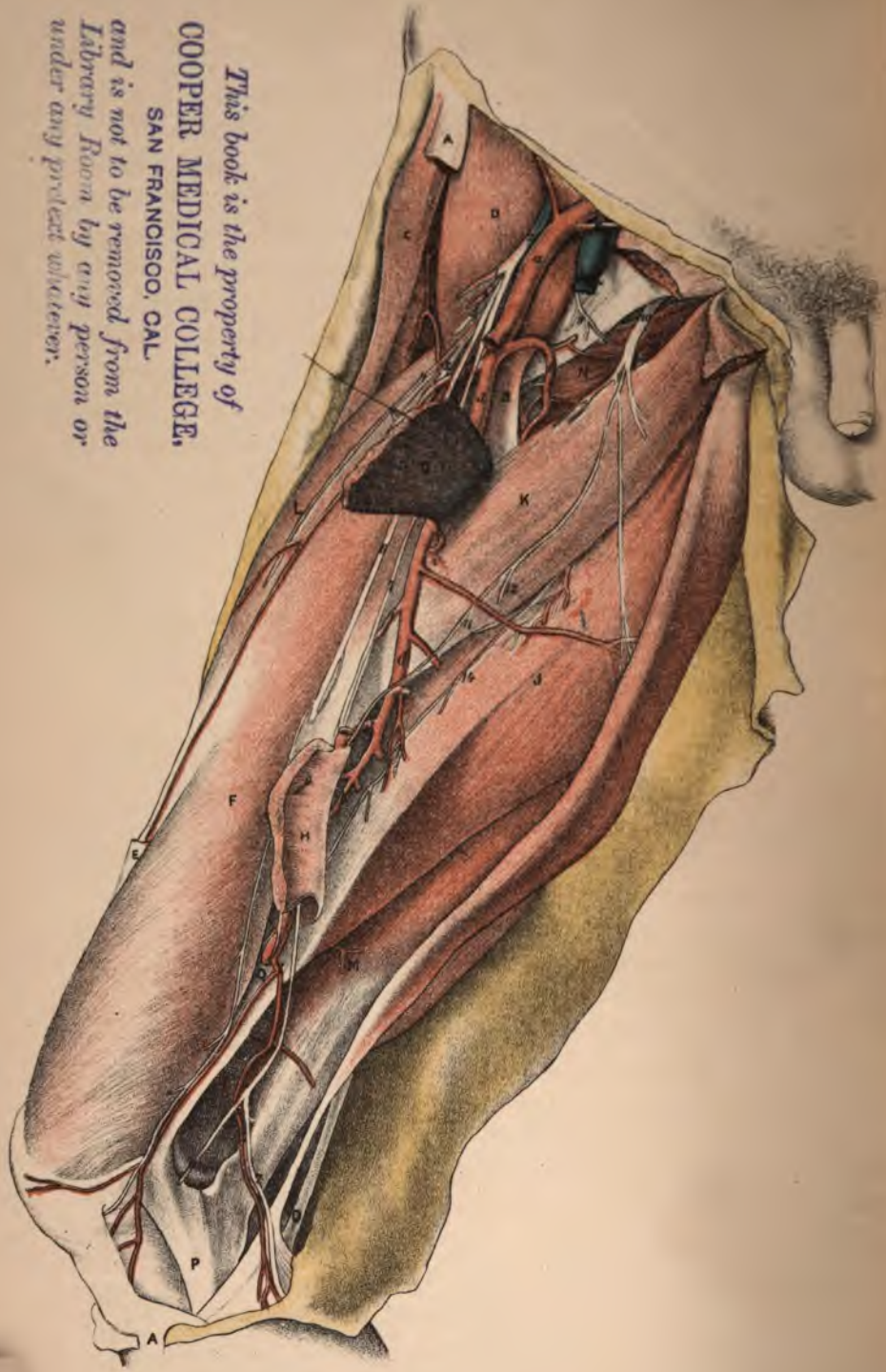
- | | |
|--|------------------------------------|
| 1. Nerve to tensor vaginæ femoris. | 5. Upper nerve to vastus internus. |
| 2. Anterior crural nerve. | 6. Lower nerve to vastus internus. |
| 3. Branches to sartorius and rectus,
cut. | 7. Internal saphenous. |
| 4. Nerve to vastus externus. | 8. Nerve to the pectineus. |

Ending of superior gluteal nerve, 1. This gluteal nerve is distributed nearly altogether to the two smaller gluteal muscles, and it ends anteriorly, as here seen, in the tensor of the fascia lata. A branch of the gluteal artery accompanies the nerve.

Anterior crural nerve, 2. The deep or muscular branches of this nerve are furnished to the triceps extensor, the sartorius, and to one other muscle, the pectineus.

Branches to rectus and sartorius, 3, 3. Each enters its muscle at the upper part; they were cut when the muscles were removed.

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Branch to the vastus externus, 4. This is a large nerve, which enters the muscle above the middle: from it a slender articular offset is prolonged on the surface of the vastus, with a superficial artery, to the capsule of the knee-joint, which it pierces.

The branches to the vastus internus are two in number. The upper one, 5, is supplied to the fleshy fibres of that part sometimes named *cru-reus*; and the lower branch, 6, which is figured in the preceding Plate, belongs to the inner part of the vastus internus and to the inner side of the knee-joint.

Nerve to the pectineus, 8. This branch separates from the trunk of the anterior crural near Poupart's ligament, and passes beneath the femoral vessels to enter the pectineus on the superficial surface. Often-times there are two nerves instead of one.

DESCRIPTION OF PLATE XLVII.

IN this Illustration the dissection of the deeper adductor muscles, with the profunda artery and obturator nerve, is exhibited.

The superficial adductors having been laid bare as in Plate XLV., the pectineus and adductor longus are to be cut through; and after removing the greater part of each of those muscles, the deeper adductors, and the ramifications of the profunda artery and obturator nerve are to be cleaned.

ADDUCTOR MUSCLES OF THE HIP-JOINT.

This group of muscles occupies the space between the pelvis and the femur, and consists of three adductors, with the pectineus and gracilis: two of the muscles, viz., pectineus and adductor longus, are represented in Plate XLV.

- A. Sartorius.
- B. Psoas muscle.
- C. Tensor vaginae femoris.
- D. Iliacus.

- E. Rectus femoris, cut.
- F. Vastus internus.
- G. Pectineus, cut.
- H. Adductor longus, cut.

I. Gracilis.
 J. Adductor magnus.
 K. Adductor brevis.
 L. Vastus externus.

M. Semi-membranosus.
 N. Obturator externus.
 O. Semi-tendinosus.
 P. Internal lateral ligament of knee.

The *pectineus* (G, Plate XLV.) is the smallest and highest of the muscles in the adductor group. It has a fleshy origin from the ilio-pectineal line of the hip-bone, and from the smooth triangular surface in front of that line; its fibres descend and are inserted by means of a thin tendon, about two inches wide, behind the small trochanter of the femur, and into the upper part of the line leading from that prominence to the *linea aspera*.

The muscle is in contact with the fascia, and forms part of the inner boundary of Scarpa's space. Beneath it lie the obturator and adductor brevis muscles, with part of the obturator nerve. Along the upper border is placed the psoas with the external circumflex vessels; and along the lower is the adductor longus.

The *pectineus* will adduct and raise the femur if this bone is not fixed; and it will take part with the rest of its group in projecting forwards the thigh in walking. When the femur is immovable, as in standing, it will assist in balancing, or drawing forwards the pelvis.

The *adductor longus* (H, Plate XLV.) is situate on the same level as the *pectineus*, but between this and the *gracilis*: it is narrow at its origin from the pelvis, but becomes wider below. Its upper tendon, about as large as the end of the finger, is fixed to the front of the pubic part of the hip-bone, just below the angle formed by the symphysis and the pubic crest; and the lower tendinous end is inserted into the inner lip of the *linea aspera*.

Partly subfascial, this adductor is covered near the femur by the *sartorius* and the femoral vessels: by the opposite surface it touches the adductor brevis and magnus, and the profunda vessels and part of the obturator nerve.

The muscle assists in bringing forwards the femur in walking; and carrying that bone towards its fellow, it will be chiefly instrumental in crossing the thighs. If the femur is fixed, as in standing, the muscle balances with others the pelvis on the limb.

The *gracilis*, I, is a thin tapering muscle, which reaches from the pelvis to the tibia. It arises by a thin tendon, from two and a half to three inches deep, along the lower border of the hip-bone, and reaches

upwards half way along the symphysis. At the lower third of the thigh it ends in a rounded tendon, and is inserted into the inner surface of the tibia, beneath the sartorius, A, but nearer the knee than the semi-tendinosus, O, which it resembles in size and form.

The muscle is superficial, and its connections are better illustrated in Plate XLIV. It lies against the adductor brevis and magnus as far as the lower third of the thigh, and thence against the semi-membranosus as it bounds internally the popliteal space. Near its insertion it is placed on the internal lateral ligament of the knee-joint, a bursa intervening; and gives an expansion to join the fascia of the leg.

With the limb free to move the gracilis will draw the femur towards the other thigh, especially after abduction of it. If the tibia is free to move the muscle will bend and rotate inwards the knee-joint; and when the tibia is fixed the muscle will act on the pelvis, like the rest of the group.

Adductor brevis, K. Deeper placed than the muscles before described, it arises beneath the adductor longus from the fore part of the os innominatum, where it is attached outside the gracilis for a distance of two inches. The muscle widens below, and is inserted into the femur behind the pectineus, and into the line prolonged from the linea aspera.

It is concealed above by the pectineus and adductor longus, but as these separate from each other below they leave a large part of the muscle uncovered: near its origin it is crossed by the superficial part of the obturator nerve, and at its insertion by the profunda vessels. The posterior surface rests on the adductor magnus, and on the deep piece of the obturator nerve and the accompanying vessels. Its upper border touches the obturator and psoas muscles, and internal circumflex vessels.

Its action is similar to that of the pectineus and adductor longus; for it engages in adduction of the femur; in the projection forwards of that bone in walking; and in supporting the pelvis in standing.

The *adductor magnus*, J, is the largest muscle in the group of adductors, and is wide and fleshy above, but narrow and tendinous below. It takes origin along the lower border of the hip-bone between the symphysis and the ischial tuberosity. From the pelvis the fibres diverge to a wide insertion into the femur, after this manner:—The anterior and upper fibres are fixed to the line continued from the great trochanter to the linea aspera, to the linea aspera itself, and for about an inch to the ridge leading from that crest of bone to the inner condyle; whilst the hinder

and lower fibres end in a strong tendon, and are attached by it to the inner condyle and the inner condyloid ridge.

This large adductor forms a triangular partition between the other adductor muscles and the hamstrings. Its upper border touches the obturator externus, and the lower is overlaid by the gracilis and sartorius. Near the femur the profunda vessels lie on it; and the muscle, united with the other adductors, is pierced by the perforating branches of those vessels. At the lower third of the thigh the adductor transmits the femoral artery through an aperture, Q, which is tendinous on the anterior and fleshy on the posterior surface.

This muscle acts powerfully as an adductor of the thigh, especially if the limb is in a state of abduction, as in riding. When the limb is behind the trunk in walking the great adductor will bring it forwards; but it does not flex the hip-joint, like the other adductors. In standing it will prop the pelvis with its companions.

Psoas and iliacus. These muscles are separate at their origin in the abdomen (p. 58), but are united near their attachment to the femur. The psoas, B, becomes tendinous below, and is inserted into the small trochanter of the femur. The iliacus, D, joins by some fleshy fibres the outer part of the psoas tendon, but the rest are continued to the femur, and are inserted into a special surface in front of, and below the small trochanter.

The two muscles cover the hip-joint, and the front of the hip-bone between the iliac crest and the ilio-pubic eminence: a large bursa separates the psoas from the joint: and a smaller one intervenes between the iliacus and the anterior margin of the bone. On the psoas lies the femoral artery; and between the two muscles the anterior crural nerve is imbedded. Internally are placed the adductor muscles with the internal circumflex vessels; and externally, are the extensor of the knee-joint, and branches of the external circumflex vessels.

These muscles flex the hip-joint, and advance the femur in front of the trunk in making a step. After the joint is flexed, they bring forward the small trochanter, and so rotate out the femur; their action on the spinal column is given before in p. 59.

Obturator externus, N. The origin of the muscle appears with the adductors, and the insertion with the muscles of the buttock. It arises from the outer surface of the anterior half of the obturator membrane, and from the contiguous part of the hip-bone; and its tendon, which is

directed backwards below the hip-joint, is inserted into the pit at the root of the great trochanter.

The muscle acts as an external rotator when the femur hangs and is free to move; but its fuller action on that bone and the pelvis will be detailed more specially with the anatomy of the external rotators.

PROFUNDA VESSELS OF THE THIGH.

The large profunda artery is the chief nutritive vessel of the thigh; and it maintains anastomoses with arteries of the buttock and leg when the femoral trunk has been rendered impervious to the blood by ligature or other cause.

- | | |
|-----------------------------------|---------------------------------|
| a. Femoral artery. | h. First perforating artery. |
| b. Circumflex iliac branch. | i. Second perforating. |
| c. Epigastric branch. | j. Third perforating. |
| d. Profunda, or deep femoral. | k. Continuation of profunda, or |
| e. External circumflex branch. | fourth perforating. |
| f. Internal circumflex branch. | l. Anastomotic branch. |
| g. Muscular branch of circumflex. | |

The *profunda artery*, *d*, arises from the femoral trunk about one inch and a half below Poupart's ligament; and it is called sometimes deep femoral from its position to the parent trunk. It courses on the inner side of the femur parallel to, but beneath the femoral trunk, as far as the lower third of the thigh, where a fine branch continues it onwards to the back of the limb. It has the following connections with muscles:—At first it rests on the iliacus, and appears external to the femoral artery in Scarpa's triangular space; then it is directed down and in under the femoral vessels, lying over the pectineus and adductor brevis; finally it enters beneath the adductor longus, and ends in a small perforating branch to the back of the thigh. Its named offsets are two circumflex, and four perforating; but it furnishes also large unnamed muscular and anastomotic branches.

Circumflex branches. Two in number, they wind backwards, one inside and the other outside the femur, like the corresponding arteries in the upper limb, and communicate at the back of the thigh.

The *external circumflex*, *e*, is consumed chiefly in the extensor muscle

of the knee-joint (p. 126), and its ramifications are displayed in Plates XLVI. and LII.

The *internal circumflex*, *f*, bends back between the psoas, B, on the one side, and the pectineus and adductor brevis, G and K, on the other, and divides opposite the small trochanter into two terminal pieces—an ascending to the buttock, and a transverse to the back of the thigh (Plate L.).

In this course it furnishes an articular branch to the hip-joint, and muscular offsets to the obturator externus and the adductors: the largest of these, *g*, passes beneath the adductor brevis, supplying it and the adductor magnus, and accompanies the deep part of the obturator nerve.

Perforating arteries. Four in number, they pierce the aponeuroses of the adductor muscles, close to the femur, and are named first, second, etc. After reaching the back of the thigh they supply muscular offsets to the biceps, and then turn round the femur on the outside to end in the vastus externus. See Plate LII.

The *first perforating*, *h*, arises opposite the lower border of the pectineus muscle, and perforates the adductor brevis and magnus.

The *second perforating*, *i*, leaves the trunk half way down the adductor brevis, and passes through the same adductors as the preceding branch: it gives an offset to the shaft of the femur.

The *third perforating*, *j*, springs from the profunda at the lower border of the adductor brevis, and is transmitted through the adductor magnus to its destination.

The continuation of the profunda or the *fourth perforating*, *k*, pierces the great adductor muscle near the opening for the femoral artery.

Muscular branches of the profunda enter the adductors; but the largest, three or four in number, pass through the adductor magnus to end in the hamstring muscles behind, where they maintain a chain of anastomoses at the back of the thigh (Plate LII.).

The *profunda vein* accompanies the artery of the same name, and ends above in the femoral vein. In this course it is superficial to its artery, and is situated between the trunks of the femoral and profunda arteries.

NERVES OF THE FRONT OF THE THIGH.

Two nerves are included in this dissection, viz., the anterior crural, and the obturator; the first nerve and its branches are marked by the same numbers as in the preceding Figure.

- | | |
|---|--|
| 1. Anterior and middle cutaneous of the thigh, cut. | 9. Accessory obturator nerve. |
| 2. Trunk of the anterior crural. | 10. Superficial part of the obturator. |
| 3. Nerve of the rectus, cut. | 11. Piece to the femoral artery. |
| 4. Nerve to the vastus externus. | 12. Piece to join the internal cutaneous. |
| 5. Upper nerve to vastus internus. | 13. Deep part of the obturator. |
| 6. Lower nerve to vastus internus. | 14. Articular branch of the obturator to the knee-joint. |
| 7. Internal saphenous nerve. | |
| 8. Patellar branch of saphenous. | |

Anterior crural nerve, 2. The view of the nerve in this Plate is very similar to that in the preceding Figure: its description has been given at p. 120.

The *obturator nerve* ramifies amongst the adductor muscles.* Beginning in the lumbar plexus (p. 70), it leaves the pelvis through the aperture in the upper part of the thyroid foramen, and divides into two pieces, superficial and deep, as it escapes from the cavity. It is especially the nerve of the adductors, for it supplies all the muscles of the group except the pectineus; and it furnishes offsets also to one external rotator of the hip, viz., the obturator externus.

The *superficial part, 10*, ends on the femoral artery; and it is directed to its vessel over the adductor brevis, but beneath the pectineus and adductor longus.* It furnishes branches to adductor brevis and longus, and to the gracilis; and it communicates by the offset, 12, with the internal cutaneous branch of the anterior crural nerve.

Before this part of the obturator nerve reaches the thigh it gives an articular branch to the hip-joint; and beneath the pectineus it is joined (sometimes) by a communicating offset of the accessory obturator nerve, 9.

* In the Figure the nerve appears to cross over the ad. longus, but this is occasioned by the muscle being cut, and the nerve being displaced; its natural position to that muscle is given in Plate XLV.

The *deep part* of the nerve, 13, pierces the fibres of the external obturator muscle and is continued into the thigh beneath the adductor brevis, furnishing branches to this muscle and the adductor magnus; and from the ending a long slender articular filament is continued through the adductor magnus, near the opening for the femoral vessels, to supply the popliteal artery and the knee-joint (Plate LII.). From the deep part of the nerve branches are supplied to the external obturator muscle.

The *accessory obturator nerve*, 9, is a small branch of the lumbar plexus, which is but rarely present. It courses from the abdomen over the front of the hip-bone, lying close inside the psoas muscle; it then bends outwards under the pectineus, where it joins the superficial part of the obturator nerve, and supplies the hip-joint. When it is large it furnishes occasionally a branch to the pectineus.

DESCRIPTION OF PLATE XLVIII.

IN this Illustration the gluteus maximus may be observed in its *natural position*, together with the nerves and vessels superficial to it.

The skin having been reflected, as in the Figure, the cutaneous nerves and vessels will be found in the fat in the positions indicated in the Plate. After the examination of the cutaneous nerves and vessels the gluteus may be cleaned by beginning at the upper border in the right limb, and at the lower border in the left limb.

CUTANEOUS NERVES AND VESSELS OF THE BUTTOCK.

The cutaneous nerves of the buttock are derived from many sources, and come from both the anterior and posterior primary trunks of the spinal nerves. Small superficial vessels accompany the nerves.

- | | |
|--|--|
| 1. Lateral cutaneous of the last dorsal nerve. | 2. Lumbar nerves (posterior primary trunks). |
| 1'. Iliac branch of ilio-hypogastric. | 3. Sacral nerves (posterior primary trunks). |

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| 4. Sacral nerves (anterior primary trunks).
5. Perinæal branch of the fourth sacral (anterior primary trunk).
6. Recurrent cutaneous of small sciatic. | 7. Hæmorrhoidal branch of the pudic.
8. Inferior pudendal of the small sciatic.
9. Cutaneous to the thigh of the small sciatic.
10. Small sciatic nerve. |
|--|---|

The *lateral cutaneous* of the *last dorsal* nerve, 1, descends from the abdominal wall over the fore part of the iliac crest, and continues in the fat as far as the great trochanter.

The *iliac branch*, 1', of the *ilio-hypogastric nerve* (p. 70) crosses the iliac crest close to the bone, and commonly behind the last dorsal: it extends to the fat over the great gluteal muscle. This nerve is sometimes large, and takes the place of the last dorsal; or it may be wanting.

Posterior lumbar nerves, 2. Cutaneous branches of the posterior primary trunks of the lumbar nerves, commonly two in number, enter the teguments at the anterior border of the erector spinæ muscle, and are directed downwards over the gluteus towards the great trochanter.

Posterior sacral nerves, 3. The posterior primary trunks of the first three sacral nerves pierce the fibres of the gluteus maximus, after uniting beneath it (Plate L.). Two or three become cutaneous, and bend outwards over the gluteus; the largest is opposite the end of the sacrum.

Anterior sacral nerves, 4. Branches of the anterior primary trunks of the sacral nerves pierce the coccygeus and gluteus maximus, and end in the neighboring integuments.

Two other small nerves of the perinæum issue beneath the lower edge of the gluteus. One is the *perinæal branch*, 5, of the fourth sacral nerve—and the other is the *inferior hæmorrhoidal* nerve, 7, of the pudic. Both of these have been noticed in page 15.

The *small sciatic nerve*, 10, of the sacral plexus appears at the lower border of the great gluteal muscle, and is then continued along the thigh (Plate LII.). Near the lower border of the muscle it gives two sets of cutaneous branches—ascending and descending.

The ascending or recurrent set, which are marked with 6, wind over the edge of the gluteus, and end in the integuments over the lower part of that muscle.

The descending set, shown by the number 9, supply the integuments of the inner part of the thigh below the buttock. One of these, 8, which

is larger than the rest, is distributed to the integuments of the scrotum or the labium, according to the sex (p. 20), and is named *inferior pudendal*.

The *external cutaneous* of the thigh, a branch of the lumbar plexus (p. 70), furnishes offsets to the fore part of the region laid bare.

The *cutaneous vessels*, like the nerves, are derived from several sources. Accompanying the last dorsal nerve, 1, is a branch of the lowest intercostal artery; and running with the ilio-hypogastric, 1', is a small branch of a lumbar artery. With the lumbar nerves, 2, are offsets of the posterior branches of the lumbar arteries; and with the sacral nerves, 3 and 4, are branches of the sciatic artery. The offsets of the small sciatic nerve, 10, have, as their companions, ramifications of the sciatic artery. Through the upper part of the gluteus branches of the gluteal artery penetrate; and through the lower part, the branches of the sciatic artery. At the upper border of the gluteus appear offsets also of the gluteal artery: and small branches of the external circumflex of the profunda perforate the fascia lata over the great trochanter.

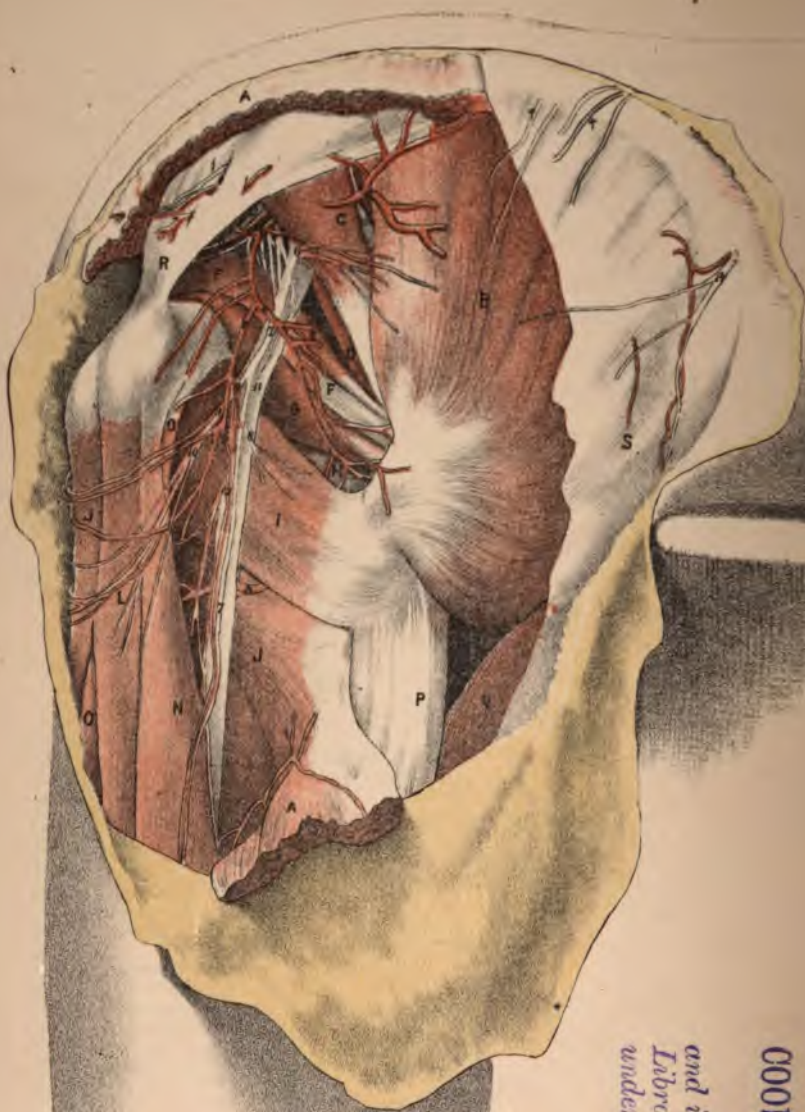
MUSCLES OF THE BUTTOCK.

Only the great gluteal muscle is dissected in this stage, though two other glutei cover the hip-bone; and one, the gluteus medius, shows through the fascia in the Plate. Issuing beneath the gluteus maximus are the hamstring muscles of the thigh.

- | | |
|---------------------------------------|--------------------------|
| A. Gluteus maximus. | D. Biceps flexor cruris. |
| B. Gluteus medius, covered by fascia. | E. Semitendinosus. |
| C. Fascia lata of the thigh. | F. Semimembranosus. |
| | G. Adductor magnus. |

The *gluteus maximus*, A, reaches from the pelvis to the femur, and resembles the deltoid muscle of the upper limb in its position, and in the coarseness of its fibres.

The pelvic attachment, or the origin, is fixed, from above down, to the posterior third of the crest and the contiguous part of the hip-bone, to the tendon of the multifidus spinæ, to the last piece of the sacrum, and to the side of the coccyx and the great sacro-sciatic ligament. From attachment the coarse bundles of fibres are directed downwards and



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outwards, and becoming tendinous are inserted into the fascia lata and the femur—about the upper two-thirds joining the fascia, and the rest the bone. The precise insertion is made evident in Plate LII., where the muscle is partly cut through and reflected.

This gluteus is covered by the fascia lata and teguments; and it is in contact by the deep surface with the parts displayed in Plate XLIX. Its upper border, the shortest, is crossed by cutaneous vessels and nerves, and rests on the gluteus medius; whilst the lower border forms part of the ischio-rectal fossa, and lies over the adductor magnus and the hamstring muscles. Round the lower border wind branches of the small sciatic nerve with their accompanying vessels.

If the femur is immovable the muscles of both sides will assist in balancing the pelvis on the thigh-bones, as in standing; and if the pelvis is bent forward, as in stooping to the ground, the large glutei will act powerfully in bringing the trunk into the erect position. In rising from the sitting to the upright posture, these muscles are chiefly active, becoming extensors of the hip-joints. In standing on one leg, say the right, the trunk will be rotated on its bony prop, so as to have the face turned to the left side.

If the thigh-bone is free to move, the muscle will rotate out the femur, and will then abduct, and carry back that bone so as to extend the hip-joint.

DESCRIPTION OF PLATE XLIX.

THE second stage of the Dissection of the buttock is depicted in this Figure.

The view here given may be obtained by cutting vertically through the gluteus maximus near the pelvic attachment, and removing carefully all the fat from the underlying muscles, vessels, and nerves. On the fore part of the gluteus medius the fascia lata has been left.

MUSCLES OF THE BUTTOCK.

Two groups of muscles occupy the back of the pelvis, viz., the glutei or abductors of the hip, and the external rotators of the same joint.

- | | |
|--------------------------|----------------------------------|
| A. Gluteus maximus, cut. | J. Adductor magnus. |
| B. Gluteus medius. | L. Semitendinosus. |
| C. Piriformis. | N. Biceps cruris. |
| D. Gluteus minimus. | O. Semimembranosus. |
| E. Gemellus superior. | P. Vastus externus. |
| F. Obturator internus. | Q. Tensor vaginæ femoris. |
| G. Gemellus inferior. | R. Great sacro-sciatic ligament. |
| H. Obturator externus. | S. Fascia lata on the gluteus. |
| I. Quadratus femoris. | |

The *gluteus medius*, B, is placed farther forwards than the *gluteus maximus*, and the fibres converge to the top of the trochanter. It arises from the outer surface of the os innominatum between the crest and the upper curved line, except behind where the *gluteus maximus* is attached, extending nearly to the hinder border of the bone; and the superficial fibres are attached to the fascia lata. The muscle is inserted below across the outer surface of the great trochanter from the tip to the root.

The muscle is in part subcutaneous, and is in part covered by the *gluteus maximus*. Its anterior border touches the tensor fasciæ latæ, Q; and the hinder border, which is contiguous to the *piriformis*, near the pelvis, overlays this muscle near the femur. Between it and the *piriformis* are seen the superficial part of the gluteal artery and the superior gluteal nerve.

The action of the muscle will vary with the state of the bones as to fixedness or mobility.

Should the femur be free to be moved the muscle will abduct it from its fellow. If the bone is hanging the anterior and lower fibres will rotate it inwards. In the beginning of a step in walking, the fore part of the muscle acts with the smallest *gluteus* in bringing forwards the hinder limb until it comes into a line with the trunk.

When both legs are fixed, as in standing, this and the small *gluteus* will aid in balancing the pelvis on the thigh bones. When the body is propped on one leg, the two smaller gluteal muscles act powerfully in keeping the hip-bone fixed; and in walking the same glutei muscles assist in balancing the trunk over the supporting limb. The anterior fibres alone acting will turn the face to the same side.

The *gluteus minimus*, D, is covered by the preceding, and is attached to the pelvis and the thigh-bone, like the *medius*; it resembles this muscle in its action, and it will be described with the following Plate.

External rotators of the hip-joint. This group consists of six muscles, viz., pyriformis, obturator internus and gemelli, quadratus femoris, and obturator externus. All are placed at the back of the joint, and are directed almost transversely from the pelvis to the top of the femur.

The *pyriformis*, C, arises inside the pelvis from the front of the sacrum (p. 74); and as it issues from that cavity by the great sacro-sciatic notch it has a further fleshy attachment to the edge of the hip-bone, and to the great sacro-sciatic ligament, R. Outside the pelvis the muscle is inserted by a narrow tendon into the top of the great trochanter between the two smaller glutei.

The part of the muscle in the buttock is concealed by the gluteus maximus, and by the gluteus medius in part; and rests on the gluteus minimus, which separates it from the hip-joint. The upper edge lies along the gluteus medius, and the lower is near the upper gemellus, E. As it escapes from the pelvis it divides into two the great sacro-sciatic notch: through the upper part issue the gluteal vessels, and the upper gluteal nerve; and through the lower come the sciatic and pudic vessels and nerves.

Should the thigh-bone hang loosely, the muscle will draw backwards the great trochanter, and give rise to rotation outwards; but should the hip-joint be bent, it will abduct the femur from the other limb. Supposing the limb fixed, as in standing, the pyriformis will help to balance the pelvis; and in rising from a stooping posture it will assist in erecting the trunk. In standing on one leg, say the right, it will rotate the trunk, turning the face to the opposite side.

The *obturator internus*, F, arises inside the pelvis, like the pyriformis, and is attached to nearly the whole inner surface of the obturator membrane, and to the greater part of the inner surface of the hip-bone behind the thyroid hole. The muscle appears through the small sacro-sciatic notch, and passes over the back of the hip-joint to be inserted into the great trochanter, in front of the pyriformis, and into the contiguous part of the neck of the femur.

Outside the pelvis the small gemelli muscles lie along the sides of the obturator; the whole is covered by the gluteus maximus, and is crossed by the sciatic vessels and nerves: underneath is the capsule of the hip-joint—a bursa intervening. In the sacro-sciatic notch, the pudic vessels with nerves lie on the muscle; and the under surface, which is tendin-

ous and divided into pieces as it rests on the bone, is lubricated by a synovial membrane.

This muscle being almost parallel to the pyriformis, its action is similar on the pendent and elevated femur; and on the pelvis when supported on both legs or on one. During walking it and the other members of its group assist the gluteus medius and minimus in fixing the pelvis on the supporting limb; and when the limb is swung forwards, it and the other rotators will keep the foot straight.

The *gemellus superior*, E, arises from the outer and lower part of the ischial spine, and is inserted with the obturator internus, which it joins. The muscle lies above the obturator internus, and is smaller than its fellow: it is often absent.

The *gemellus inferior*, G, is in contact with the lower border of the obturator internus, and is much larger than the upper gemellus. It arises from the lower edge of the groove in the hip-bone for the obturator internus; and it is inserted into the trochanter of the femur with the obturator muscle.

These muscles have the same connections as the extra-pelvic part of the obturator internus, to which they seem to be accessory heads of attachment. The upper intervenes between the obturator and the pyriformis and gluteus minimus, and the lower separates the obturator from the quadratus femoris and obturator externus. Near the pelvis the edges are applied together to form a kind of groove, which contains the obturator, but near the femur they cover the tendon of that muscle.

They act on the thigh-bone like the obturator internus, rotating out when the limb is hanging, and abducting when the femur is bent on the trunk. In standing on both legs, on one leg, and in walking, they will also assist the obturator, though their power will be but small.

The *obturator externus*, H, appears as a tendon between the inferior gemellus and quadratus femoris. Its origin opposite the obturator internus from the outer part of the membrane of the same name, and in part from the pelvis, is indicated in Plate XLVII.; and the buttock part of the muscle will be illustrated in the next Plate.

The *quadratus femoris*, I, is thin and fleshy, and arises from the outer border of the tuber ischii, external to the semimembranosus and the adductor magnus. Its fibres form a squarish layer, from two to three inches wide, which is inserted into a tubercle in the posterior inter-trochanteric line, and vertically into the upper end of the femur

for two inches: the line of attachment is sometimes called *linea quadrati*.

Covered by the same parts as the other rotators, it is also concealed at its origin by the hamstring muscles. Underneath it is the obturator externus with the hip-joint. By the upper border it touches the inferior gemellus and obturator externus; and by the lower it is in contact with the adductor magnus—a piece of the internal circumflex artery with its veins issuing between the two.

This muscle will assist, though but feebly, the pyriformis and obturators in rotating out the hanging limb; in abducting the bent limb; in balancing the pelvis in standing on both legs, or on one; and in rotating the face to the opposite side when the trunk is supported on one leg.

Hamstrings and adductor magnus. The upper ends of the three flexors of the knee-joint (hamstrings) are laid bare at their attachment to the ischial tuberosity; they consist of semitendinosus, L, biceps, N, and semimembranosus, O, and they are more fully seen in Plate LII.

Parts of the origin and insertion of the adductor magnus, which were not visible in the former view of the muscle (Plate XLVII.), are now denuded. Internal to the hamstrings may be seen the origin from the ischial tuberosity; and external to those muscles is the wide expanded part, which is inserted into the femur in a line with the quadratus femoris, and in the attachment side of the gluteus maximus.

ARTERIES OF THE BUTTOCK.

Most of the arteries of the buttock belong to the set of external parietal branches of the internal iliac (p. 67): they are the gluteal, sciatic, and pudic, which issue from the pelvis by the great sacro-sciatic notch. Branches of the profunda artery appear also in the lower part of the region dissected.

- | | |
|--|--|
| a. Superficial part of the gluteal artery. | e. Muscular and anastomatic branch of the sciatic. |
| b. Pudic artery. | f. Continuation of the sciatic. |
| c. Trunk of the sciatic. | g. Branch to great sciatic nerve. |
| d. Coccygeal branch of the sciatic. | h. Branch of internal circumflex. |
| | i. Ending of first perforating artery. |

The *gluteal artery* comes through the great sacro-sciatic notch above

the pyramiformis, and supplies the gluteal muscles. It divides at once into a superficial and a deep piece, and the latter of these will be contained in the next Plate.

The superficial part *a*, sends off many branches to the under surface of the gluteus maximus. One or two small branches run inwards and backwards through the great sacro-sciatic ligament to the integuments, and send deeper offsets to the muscle over the back of the sacrum.

The *pudic artery*, *b*, appears in the buttock for a very short distance: it leaves the pelvis through the great sacro-sciatic notch, below the pyramiformis, and then winds over the ischial spine by the side of the nerve of the same name, to enter the perineum through the small sacro-sciatic notch.

The *sciatic artery*, *c*, escapes with the pudic and sciatic vessels and nerves through the great sacro-sciatic notch, and is accompanied by cutaneous offsets of the small sciatic nerve. It supplies the part of the buttock below the gluteal artery, and furnishes the following branches:—

The *coccygeal branch*, *d*, pierces the great sacro-sciatic ligament, and supplies the gluteus maximus: one of its branches enters that muscle, and accompanies the chief cutaneous offset of the sacral nerves; whilst others ramify on the back of the sacrum and coccyx.

Muscular and anastomotie branch, *e*. This artery varies much in size, and passes transversely outwards to the root of the great trochanter. It supplies largely the gluteus maximus, and ends at the spot mentioned by anastomosing with the gluteal and internal circumflex arteries.

Nerve branches. A small artery, *g*, enters the trunk of the great sciatic nerve, and is called “comes nervi ischiadici.” And the continuation of the artery, *f*, accompanies the smaller sciatic nerve, branching like it to be distributed with the several offsets of the nerve.

Muscular branches, many of which were cut in the dissection, enter the under surface of the great gluteus, and the lower external rotator muscles; and the artery to the quadratus femoris runs to its muscle with the nerve, 5, beneath the gemelli and internal obturator.

The *internal circumflex artery* of the profunda (Plate L.) divides into two beneath the quadratus: the branch, *h*, to the thigh issues between the contiguous borders of the quadratus and adductor magnus, and is distributed to the hamstrings.

First perforating artery. This branch of the profunda pierces the adductor magnus, and supplying the gluteus maximus and the biceps muscle, *N*, ends in the vastus externus.

NERVES OF THE BUTTOCK.

Most of the nerves included in this dissection are branches of the sacral plexus, and appear at the lower border of the pyriformis, where the plexus ends: they may be arranged into branches to the limb, to the perineum, and to some external rotator muscles. By the side of the gluteal artery is the superior gluteal nerve, which is not derived from the plexus; and on the great sacro-sciatic ligament lies a branch of the sacral nerves.

- | | |
|---|--|
| 1. Cutaneous branch of the sacral nerves. | 9. Inferior pudendal nerve. |
| 2. Pudic nerve. | 10. Cutaneous of the buttock and inner part of the thigh. |
| 3. Nerve to the obturator internus. | 11. Great sciatic nerve. |
| 4. Branch to the upper gemellus. | 12. Muscular branch of the great sciatic. |
| 5. Branch to the quadratus femoris. | 13. Superior gluteal nerve. |
| 6. Upper branches to the gluteus maximus. | 14. Iliac branch of ilio-hypogastric. |
| 7. Small sciatic nerve. | †† Cutaneous of the posterior trunks of the lumbar nerves. |
| 8. Lower branches to the gluteus maximus. | |

The *small sciatic nerve*, 7, is chiefly a cutaneous nerve of the buttock, scrotum, and back of the limb, for only one muscle (gluteus maximus) receives branches from it. It begins by two or more pieces in the lower part of the sacral plexus, and takes the course of the sciatic artery over some of the external rotators, as far as the lower border of the gluteus maximus: here the nerve furnishes many branches (Plate XLVIII.), and is continued beneath the fascia of the thigh with a branch of artery to the integuments of the calf of the leg. Its offsets are these:—

Muscular or gluteal branches, 8, enter the lower part of the gluteus maximus: they are called inferior gluteal, to distinguish them from the branches of the superior gluteal nerve, for the smaller glutei muscles.

The *inferior pudendal*, 9, winds beneath the fascia lata, and below the ischial tuberosity, near which it becomes cutaneous to end in the scrotum or the labium (Plate XXXI.).

Cutaneous branches of the buttock and thigh, 10. The branches of the buttock run backwards over the gluteus maximus, and are better

shown in Plate XLVIII. The thigh-branches are inclined downwards and inwards, and piercing the fascia lata, end in the integument of the upper third of the thigh on the inner aspect.

The *great sciatic*, 11, is the largest nerve in the body; and in it the sacral plexus terminates. In its course to the back of the thigh it is placed in the hollow between the great trochanter and the ischial tuberosity, lying on the external rotators below the pyriformis; and it is concealed by the gluteus maximus till it reaches the hamstrings. As the nerve is about to leave the region of the buttock a branch for the hamstring muscles is detached from it, whose distribution will appear in Plate LII.

The *pudic nerve*, 2, turns over the small sacro-sciatic ligament by the side of the artery of the same name, and gains the perinæal space through the small sacro-sciatic notch. Its further progress is given in the Plates of the perinæum.

Muscular branches of the sacral plexus supply the gluteus maximus, and all the external rotators except the obturator externus.

The branches to the gluteus, 6, have been cut across as they pierce the muscular fibres: these are known as inferior gluteal, like the branches of the small sciatic to the same muscle, and penetrate the upper fleshy fibres.

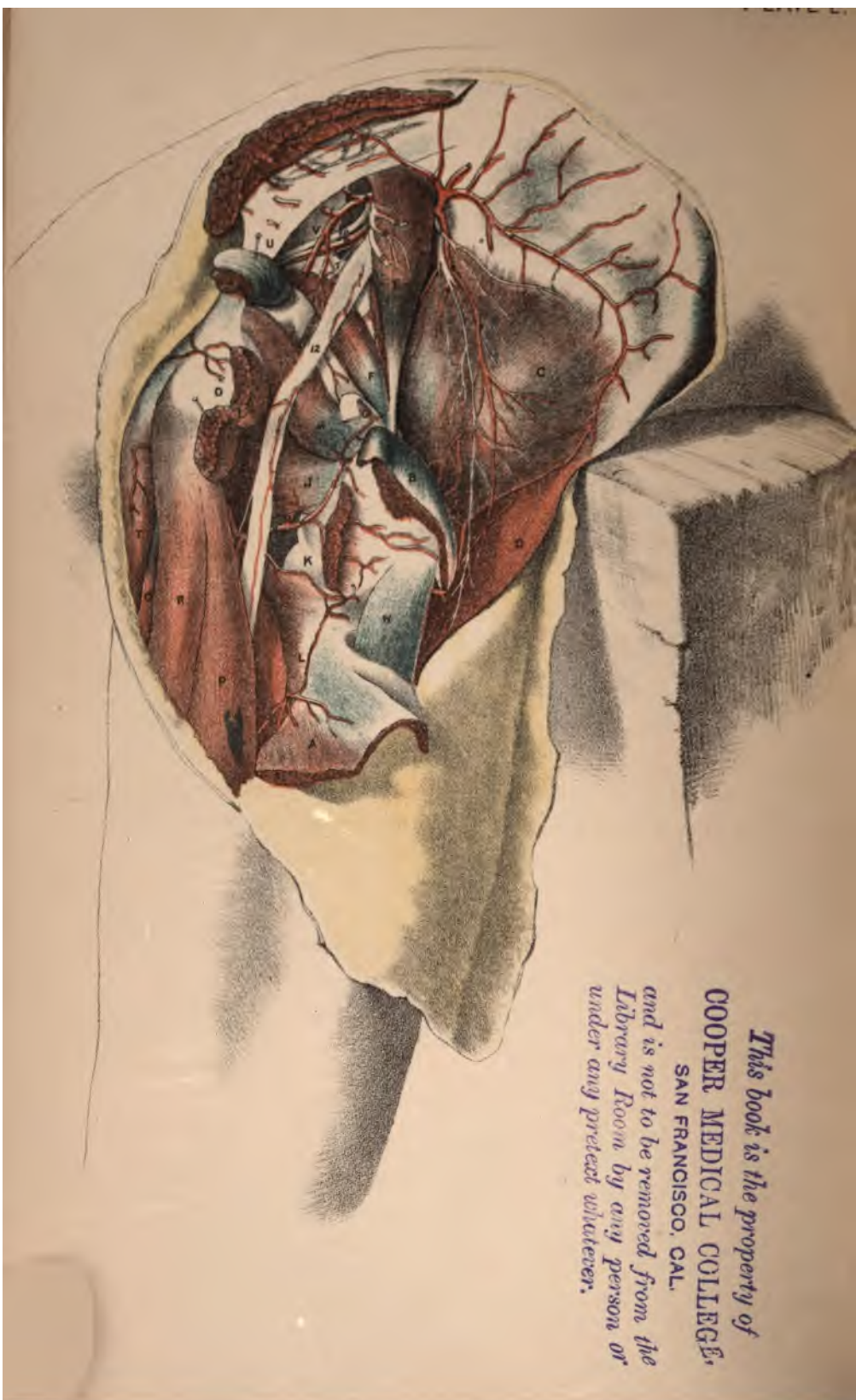
The branch to the obturator internus, 3, with its artery, accompanies the pudic vessels through the small sacro-sciatic notch, and soon sinks into the fleshy fibres.

The branch to the upper gemellus, 4, is sometimes very fine; a considerable difference in its size is manifest in the following Plate which was drawn from another body.

The branch to the inferior gemellus and quadratus, 5, is a slender nerve, which runs with a small artery beneath the gemelli and obturator internus.

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DESCRIPTION OF PLATE L.

IN this Figure the third stage in the dissection of the buttock is represented.

Supposing the second stage of the dissection to have been carried out as in the preceding Plate, the third stage will be arrived at by removing the gluteus medius, and by cutting through and reflecting the obturator internus and quadratus femoris. On taking away a superficial stratum of the great sacro-sciatic ligament the sacral nerves will come into sight.

The small sciatic nerve and the sciatic artery were cut away, and all the veins were removed with the view of rendering the connections less complicated.

DEEP MUSCLES OF THE BUTTOCK.

Two muscles, the gluteus minimus and obturator externus, come under notice for the first time; but most of the others have been demonstrated in the preceding Plate, though some points in their anatomy receive here further illustration.

- | | |
|---------------------------------------|----------------------------------|
| A. Cut ends of the gluteus maximus. | J. Obturator externus. |
| B. Insertion of the gluteus medius. | K. Insertion of psoas magnus. |
| C. Gluteus minimus. | L. Insertion of adductor magnus. |
| D. Tensor vaginæ femoris. | N. Vastus externus. |
| E. Piriformis. | O. Semimembranosus. |
| F. Upper gemellus. | P. Biceps cruris (long head). |
| G. Obturator internus, cut. | R. Semitendinosus. |
| H. Lower gemellus. | T. Origin of adductor magnus. |
| I. Cut ends of the quadratus femoris. | U. Great sacro-sciatic ligament. |
| | V. Small sacro-sciatic ligament. |

The *gluteus minimus*, C, is somewhat pyramidal in form, and is attached to the hip-bone and femur, like the gluteus medius, beneath

which it lies. It arises from the space between the two curved lines on the back of the hip-bone, and extends backwards to the line of union of the iliac and ischial portions of that bone. From this attachment the fibres are directed downwards, converging to a tendon, which is inserted along the fore part of the great trochanter, and blends inferiorly with the tendon of the *gluteus medius*. Some of the deeper fibres end in the capsule of the hip-joint (Theile).

This muscle is covered by the *gluteus medius* and *pyriformis*, and rests on the hip-bone and joint. At the anterior border is placed the tensor of the fascia lata; and at the hinder edge, the lower *gemellus*. On it lie the gluteal vessels, and the superior gluteal nerve.

In its action the muscle resembles the *gluteus medius*. For if the femur hangs loosely it will be abducted; and it may be rotated in by the anterior transverse fibres. When the body is supported on both legs this *gluteus* will act in balancing the pelvis; and when the trunk is rotated on one limb it will bring the face to the same side. At the beginning of a step in walking it advances the hindmost leg with the *gluteus medius*, and then inclines the pelvis over the supporting femur whilst the swinging limb is put forwards.

Obturator internus and gemelli. On cutting through the obturator, G, and raising the inner end, three or four tendinous pieces, separated by fleshy intervals, will appear on the under surface; and the subjacent bone will be seen to be provided with ridges of fibro-cartilage, which correspond with the fleshy interspaces. A synovial membrane lubricates the surfaces.

Near the pelvis the *gemelli* muscles, F and H, approach each other beneath the obturator, but near the femur they cover the tendon of the obturator; and all three of them pass beneath the *pyriformis* to be inserted in front of it into the trochanter and the neck of the femur. In the Drawing the muscles are separated from each other to show the nerve to the *quadratus*, 8, and its accompanying artery.

The *obturator externus*, J, arises from the outer surface (in part) of the obturator membrane, and from the bone bounding anteriorly the thyroid hole. From this widened attachment the fibres are directed almost horizontally backwards to a tendon, which is inserted into the pit at the root of the trochanter.

At the fore part of the thigh the obturator is covered by the adductors (Plate xxxvii.); and in the second view of the buttock it is concealed by

the quadratus femoris, I, except a part of the tendon which is apparent between the upper border of the quadratus and the inferior gemellus (Plate XLIX.). As the muscle passes from the front to the back of the limb it spreads over and supports the lower part of the hip-joint. Escaping beneath its lower border is the internal circumflex artery.

Like the other rotators out, the external obturator draws backwards the great trochanter when the femur hangs loosely; and even when the hip-joint is flexed it will execute the same movement of the thigh-bone, and in this respect it differs from the other muscles of its group. When the limbs are fixed as in standing it contributes its share of power in maintaining the pelvis upright on the femur; and in standing on one leg it helps also to fix the pelvis.

Psoas magnus, K. The tendon of this muscle inclines over the hip-joint and the neck of the femur to its insertion into the small trochanter.

The *sacro-sciatic ligaments* connect the back of the hip-bone to the sacrum and coccyx: they are two in number, and are named large and small.

The *large ligament*, U, is wide and thin internally, but thicker and pointed externally. It is attached by its widened part to the back of the hip-bone, to the side of the sacrum, and to the side of the coccyx. Its fibres are directed backwards and outwards, and being aggregated together, are inserted into the inner side of the ischial tuberosity and lower border of the hip-bone. It closes below the great sacro-sciatic notch of the pelvis, and gives origin to fibres of the gluteus maximus. Branches of the gluteal and sciatic arteries perforate the ligament, and the offsets of the posterior sacral nerves lie beneath a superficial layer of its fibres.

The *small ligament*, V, unites internally with the larger band, and is attached with it to the side of the sacrum and coccyx. Its constituent fibres are coarse, and pass outwards to be inserted into the ischial spine. By its position it divides into two apertures the space included by the hip-bone and the great ligament.

The upper and larger aperture or notch is bounded above by the hip-bone, and below by the small sacro-sciatic ligament. Through it are transmitted the pyriformis muscle, and vessels and nerves. Above the muscle issues the gluteal artery, *a*, with its veins, and the upper gluteal nerve, 4; and below the muscle issue the great and small sciatic nerves, 6 and 12, the pudic nerve, 10, and the sciatic and pudic vessels, *l* and *g*.

The lower and smaller aperture intervenes between the attachments of the two ligaments to the hip-bone, and gives passage to the obturator internus muscle, G, the pudic artery, *g*, with its veins, the pudic nerve, 10, and the nerve to the obturator muscle, 9, with its vessels.

ARTERIES OF THE BUTTOCK.

Parts of the gluteal, sciatic, and pudic arteries of the internal iliac; branches of the internal and external circumflex arteries; and offsets of the first perforating artery of the profunda, are included in the dissection; but the gluteal and internal circumflex will be referred to here more especially.

<i>a.</i> Trunk of gluteal.		<i>n.</i> Transverse	} of the circum-
<i>b.</i> Superficial	} of the gluteal.	<i>o.</i> Ascending branch	
<i>c, d.</i> Deep branch		<i>r.</i> First perforating of the profunda.	
<i>e.</i> Sciatic artery, cut.		<i>s.</i> Branch of perforating to the bi-	
<i>f.</i> Coccygeal branches.		ceps.	
<i>g.</i> Pudic artery.		<i>t.</i> Ascending branch of perforating	
<i>h.</i> Branch of the quadratus.		to join circumflex.	
<i>l.</i> Ending of the internal circum-		†† Branches to the sciatic nerve from	
flex.		the sciatic artery.	

The *gluteal artery*, *a*, escapes from the pelvis through the upper part of the great sacro-sciatic notch, as before said, and divides into superficial and deep muscular branches.

The *superficial part*, *b*, appears between the gluteus medius and the pyriformis (Plate XLIX.), and pierces the under surface of the gluteus maximus (p. 142).

The *deep part* divides into two chief branches, which are continued forwards between the gluteus medius and minimus.

One, *c*, courses over the origin of the gluteus minimus to the fore part of the iliac crest, where it anastomoses with the external circumflex of the profunda: it furnishes branches to both the smaller glutei, but chiefly to the medius; and some offsets ascend over the iliac crest to communicate with arteries in the wall of the abdomen.

The other branch, *d*, crosses the middle of the smallest gluteal muscle, and ends in front by supplying the tensor of the fascia lata, and by anastomosing, like the upper branch, with the external circumflex: its offsets are given to the two muscles between which it lies, but most belong

to the smallest gluteus. A considerable branch passes beneath the pyramiformis, and penetrates the fibres of the gluteus minimus; some of its ramifications are prolonged to the hip-joint.

The *gluteal veins* have the same anatomy as the artery, and open into the internal iliac vein; they were removed in the dissection.

The *sciatic* and *pudic arteries*, *e* and *g*, have been described with the preceding Plate (p. 142). Several offsets of the sciatic artery, which enter the great sciatic nerve, are marked thus, †.

The *internal circumflex artery* of the profunda, *l* (p. 132), divides beneath the quadratus into two terminal branches,—ascending and transverse.

The ascending branch, *o*, follows the obturator externus muscle beneath the quadratus femoris to the pit at the root of the great trochanter, and anastomoses there with the gluteal artery; it gives small muscular branches to the quadratus, obturator, and gemelli, and some offsets extend to the surface of the great trochanter.

The transverse branch, *n*, passes back between the borders of the quadratus, *I*, and adductor magnus, *L*, and sends branches to the muscles attached to the ischial tuberosity, some small offsets reaching the surface of both the adductor and the great sacro-sciatic ligament, as in the Figure. It anastomoses beneath the hamstrings with the highest muscular branch of the profunda; and with the first perforating artery of the profunda, *r*, by means of a small branch which crosses the upper edge of the adductor magnus near the attachment to the femur, and joins the ascending offset, *t*, from that perforating artery.

External circumflex of the profunda, *i*. The ascending branches of this artery course beneath the tensor of the fascia lata to the hip-bone, where they supply the glutei and the tensor, and anastomose with the gluteal artery. In detaching the gluteus medius the branches to it were cut. Offsets from it are given to the trochanter.

The *first perforating artery* of the profunda, *r* (p. 132), comes through the adductor magnus, and ends in the vastus externus; it supplies offsets to the gluteus maximus and the long head of the biceps, and communicates by the branch, *t*, with the internal circumflex.

NERVES OF THE BUTTOCK.

The chief nerves of the buttock appear below the pyriformis, and are derived from the sacral plexus; but above the pyriformis comes the upper gluteal nerve; and on the great sacro-sciatic ligament are sacral nerves.

- | | |
|---|---|
| 1, 2, 3. Branches of the posterior sacral nerves. | 8. Nerve to the quadratus femoris. |
| 4, 5. Branches of the superior gluteal nerve. | 9. Nerve to the obturator internus. |
| 6. Branches of the small sciatic, cut. | 10. Pudic nerve. |
| 7. Nerve to the upper gemellus. | 12. Great sciatic nerve. |
| | †† Cutaneous branches of the sacral nerves. |

Posterior sacral nerves, 1, 2, 3. These are the external branches of the posterior primary trunks of the first three sacral nerves; the highest is marked with number 1, and the lowest with 3. At first they are directed out beneath the multifidus spinæ muscle, and then unite, in the manner shown in the Figure, beneath a thin layer of fibres of the great sacro-sciatic ligament. From this plexiform union of the nerves two or three offsets are continued through the gluteus maximus to the integuments of the buttock (Plate XLVII.). The nerves are not always joined in the manner indicated.

Upper gluteal nerve. Springing from the large lumbo-sacral trunk which connects together the lumbar and sacral plexuses (p. 70), it issues from the pelvis above the pyriformis muscle with the gluteal artery. As soon as it comes into sight it divides, like the artery, into two pieces, which run forwards between the two smaller gluteal muscles.

The upper or more superficial branch, 4, enters the gluteus medius; and the deeper part, 5, furnishes offsets to both the gluteus medius and minimus, and ends anteriorly in the tensor fasciæ latæ.

Branches of the sacral plexus. These nerves have been referred to in the preceding Plate, but some of them are more fully displayed in this deeper dissection.

The *thigh-branches* are the small and large sciatic nerves. The branches of the former have been cut across, and are marked with 6. The larger nerve is pointed out by the number 12.

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The *pudic* or *perineal nerve*, 10, is directed over the small sacro-sciatic ligament to the perinæum, and is accompanied by the pudic artery and the nerve to the obturator internus.

Branches to external rotators. All the external rotators, except the obturator externus, obtain nerves from the sacral plexus. The obturator internus receives the nerve, 9, at its inner or pelvic aspect. To the upper gemellus the slender nerve, 7, is distributed; it enters the superficial surface. Two nerves enter the pyriformis at the under surface, but these are not visible until the muscle has been cut and reflected.

The quadratus and inferior gemellus are supplied by the nerve, 8, which passes beneath the upper gemellus and the obturator internus, and pierces the under surface of the quadratus near the upper border. As the nerve crosses under the inferior gemellus it sends an offset to that muscle; and as it lies on the capsule of the hip-joint, fine filaments penetrate that membrane to end in the synovial sac.

DESCRIPTION OF PLATE LL.

THE popliteal space or the ham, with its contents, is delineated in this Figure.

For the dissection of the ham the skin and the deep fascia are to be reflected by a median incision, terminated by a cross cut at each end. The large quantity of fat, which then comes into view, is to be removed with care; for articular vessels and nerves, and other nerves and arteries to muscles, cross through the deeper region of the hollow. On the side of the artery some lymphatic glands are to be separated from the surrounding fat.

FORM, SIZE, AND BOUNDARIES.

The ham is placed at the back of the knee-joint, and corresponds with the interval in front of the elbow in the upper limb. Like the intermuscular space which it resembles, it is situate on that aspect of the joint to

which flexion takes place, and lodges the main vessels and nerves of the limb.

A. Biceps cruris.	E. Sartorius.	
B. Semimembranosus.	F. Plantaris.	
C. Semitendinosus.	G. Outer head	} of the gastro-
D. Gracilis.	H. Inner head	
		} cnemius.

In form the popliteal space is lozenge-shaped, with the points directed up and down. Before its lateral boundaries are disturbed it extends about two inches and a half above the knee-joint, and downwards about one inch and a half from the same point; but its length will vary with the degree of separation of the hamstring muscles.

This hollow is produced by the arrangement of the muscles at the knee, for the hamstrings and the heads of the gastrocnemius and the plantaris, as they pass the joint, are collected on the sides of the limb, and give rise thus to the angular interval of the popliteal space. By the removal of the muscles from the midline of the limb to the side, greater extent of bending is permitted in the joint.

Towards the surface the ham is closed by the teguments, and by the fascia lata strengthened by transverse fibres from the tendons of the hamstrings. And the bottom of the space is formed by the femur and the knee-joint.

Laterally it is inclosed by the intermuscular septa, which are inserted into the condyloid lines of the femur, and by the following muscles. On the outer side lies the biceps muscle, A, as low as the condyle of the femur; and below that point come the plantaris, F, and outer head of the gastrocnemius, G. On the inner side it is limited as low as the condyle by the semimembranosus, B; by the semitendinosus, C, lying on the other; and by the sartorius and gracilis, D and E, which intervene between the semimembranosus and the femur; and below the condyle is situate the inner head of the gastrocnemius, H.

The upper and lower points or angles are constructed also by muscles. At the upper, the biceps, A, and semitendinosus, C, are in contact; and at the lower, the inner head of the gastrocnemius, H, comes into apposition with the plantaris and the outer head of the gastrocnemius, F and G.

The depth of the space is greater above than below the knee-joint,

and is greatest opposite the inter-condyloid hollow of the femur. The widest part is on a level with the condyles of the femur.

The ham is closed on all sides except above and below, and at those spots it communicates with the back of the thigh and leg. Above, a probe can be pushed under the hamstrings along the course of the internal popliteal nerve; and below, it can be passed under the gastrocnemius, by the side of the great bloodvessels. Blood poured out from the vessels into the hollow would diffuse itself under the muscles of the thigh and leg in the channels indicated.

In the popliteal space are contained the large bloodvessels and nerves of the limb, with their branches; a branch of the obturator nerve; an offset of the small sciatic nerve, with its artery, and lymphatics, with much fat.

VESSELS OF THE HAM.

The chief vessels in the ham are the popliteal artery and vein, which wind from the fore part to the back of the limb above the knee, so as to pass the knee-joint on the flexion-side; but branches of those trunks cross the space, and a small superficial artery, accompanying the small sciatic nerve, is continued through it to the leg.

- | | |
|--|---|
| <p><i>a.</i> Popliteal artery.</p> <p><i>b.</i> Upper external articular.</p> <p><i>c.</i> Upper internal articular.</p> <p><i>d.</i> Cutaneous branches with veins.</p> <p><i>e.</i> Cutaneous branch with the small sciatic.</p> <p><i>f.</i> Cutaneous branch of the anastomotic.</p> | <p><i>g.</i> Internal sural to gastrocnemius.</p> <p><i>h.</i> Short saphenous vein.</p> <p><i>i.</i> Cutaneous veins of the back of the leg.</p> <p><i>l.</i> Popliteal vein.</p> <p><i>n.</i> External sural artery to the gastrocnemius.</p> |
|--|---|

The *popliteal artery*, *a*, begins and ends beyond the limits of the space now defined. The part of the artery contained in the ham courses obliquely from the inner side above to the mid-point of the space below. At first it issues from beneath the semimembranosus, *B*, but it lies afterwards in the hollow between the condyles of the femur and the heads of the gastrocnemius. It is deeply placed throughout, and rests on the lower end of the femur and the knee-joint. Internally it is in contact with the semimembranosus, *B*, and with the inner head of the gastro-

cnemius, H ; and the first muscle would serve as a guide to the position of the vessel. It has the following connections with veins and nerves:

The popliteal vein, *l*, is closely united to the artery throughout. At the upper end of the space it is external to the arterial trunk, whilst towards the lower end, or between the heads of the gastrocnemius, it becomes superficial to that vessel. Some small cutaneous veins, *i*, cross the inner side of the artery in their course to join the popliteal vein.

The internal popliteal nerve, 3, passes through the ham from the upper to the lower angle, and is much more superficial than the blood-vessels. At first it lies outside the line of the vascular trunks, but is placed over these between the heads of the gastrocnemius. Some of its branches touch the vessels ; for instance, the short saphenous nerve, 4, lies on the popliteal trunks below, and the nerve, 6, to the inner head of the gastrocnemius, crosses them ; further, the azygos articular nerve, 7, enters the back of the joint beneath the vessels.

Much more superficial than the internal popliteal trunk, 3, is the continuation of the small sciatic nerve, 2, with accompanying vessels ; and resting on the popliteal artery is the articular branch of the obturator nerve.

Branches of the artery. In the popliteal space the artery furnishes muscular and articular branches.

Muscular branches. These are supplied from the upper and lower parts of the trunk. The upper enter the biceps and semimembranosus ; and the lower or sural, *g* and *n*, are distributed to the heads of the gastrocnemius and the plantaris.

Articular arteries. Only the upper pair is visible ; and the two are attached to the arterial trunk rather above the knee-joint. The outer branch, *b*, crosses the femur above the condyle, and passing under the biceps, leaves the ham by perforating the external intermuscular septum. The inner, *a*, is directed beneath the inner hamstrings and the tendon of the adductor magnus to the front of the knee-joint.

A single median (azygos) articular branch enters the joint through the posterior ligament, but it is concealed by the trunks of the vessels.

NERVES OF THE SPACE.

In the ham are lodged the two great trunks into which the sciatic nerve splits, with branches of these; and in the space are offsets of the small sciatic and obturator nerves.

- | | |
|--|------------------------------------|
| 1. Internal cutaneous of the thigh. | 7. Middle articular branch. |
| 2. Small sciatic nerve. | 8. External articular branch. |
| 3. Internal popliteal nerve. | 9. Communicating peroneal branch. |
| 4. Short saphenous nerve. | 10. External cutaneous of the leg. |
| 5, 6. Branches to the heads of the
gastrocnemius. | 11. External popliteal nerve. |

Popliteal nerves. At the back of the thigh the sciatic nerve divides into the internal and external popliteal trunks (Plate LII.); these are continued through the ham to the leg, and furnish branches to the surrounding parts.

The internal or larger trunk, 3, lies nearly in the middle of the limb, and takes the position, before said, to the bloodvessels (p. 154): it gives articular branches to the knee-joint; muscular to the gastrocnemius, plantaris, and soleus; and a cutaneous nerve (short saphenous) to the back and outer part of the leg.

The external popliteal, 11, is placed under cover of the biceps muscle, and leaves the space below to reach the fore part of the leg. Near its commencement it gives an articular nerve, 8, to the knee-joint; and whilst it is contained in the space two or three cutaneous nerves to the back and outer part of the leg arise from it. No muscles receive branches from this trunk.

The *small sciatic nerve*, 2, is continued through the popliteal space, immediately beneath the fascia lata, to end in the integuments of the back of the leg (Plate LIII.).

The *obturator nerve* courses along the popliteal artery to reach the knee-joint, to which it is distributed: it is more fully seen in the following Plate.

Lymphatics. Large lymphatic vessels with some glands lie along the bloodvessels. The glands are three or four in number, and through

them pass the lymphatics accompanying the tibial bloodvessels and the short saphenous vein.

Fat in the ham. A loose granular fat, similar to that in the ischio-rectal fossa, fills the popliteal space, and surrounds loosely the vessels and nerves, so as to permit their necessary displacement in the movements of the knee-joint. Above and below it is continuous with the areolar tissue and fat of the thigh and leg. Abscesses form readily in it, and may acquire large size without giving rise either to swelling on the surface, or to fluctuation. From the strength and completeness of the subcutaneous boundary the pus does not find its way readily to the surface; and to prevent this fluid burrowing upwards and downwards under the muscles, where the popliteal space is not closed by fascia, incisions should be made through the fascia lata.

DESCRIPTION OF PLATE LII.

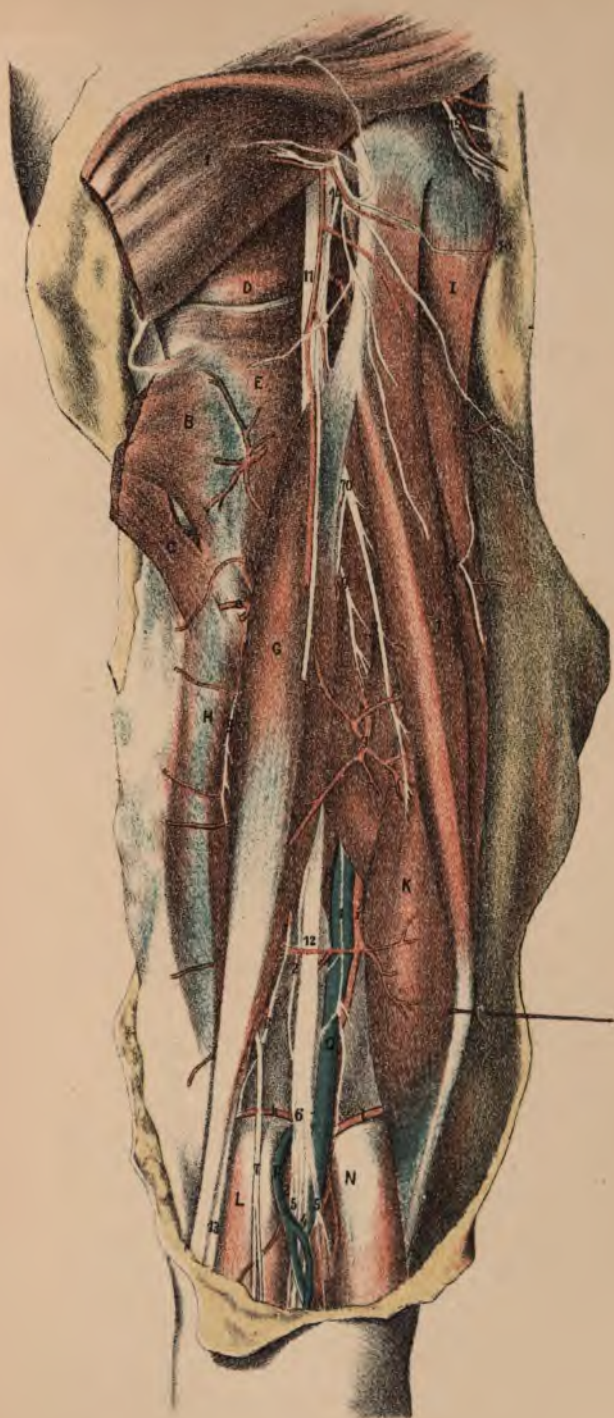
IN this Figure a view of the dissection of the back of the thigh is given.

After the popliteal space has been examined, the hinder part of the thigh may be exposed, by slitting up and reflecting the skin and the fascia between the ham and the buttock. The surface of the muscles having been cleaned, these may be separated from each other to trace the vessels and nerves.

MUSCLES OF THE BACK OF THE THIGH.

Behind the femur are situate the flexor muscles of the hip-joint, which are called commonly the hamstrings. At this stage of the dissection the insertion of the gluteus maximus can be better seen than in Plate XLVIII., where the muscle is delineated.

A.B.C.	Insertion of the gluteus maximus.	I.	Ischial part of the adductor magnus.
D.	Quadratus femoris.	J.	Semitendinosus.
E. F.	Insertion of the adductor magnus.	K.	Semimembranosus.
G.	Long head of the biceps.	L.	Outer head of the gastrocnemius.
H.	Short head of the biceps.	N.	Inner head of the gastrocnemius.



1

2

3

4

Insertion of the gluteus maximus. The fibres of this muscle are inserted partly into the fascia lata, and partly into the femur. About the upper two-thirds of the whole (as far as A) end in the fascia lata. The remaining fibres are inserted by two parts;—one, B, the larger, is fixed into the line leading from the linea aspera to the great trochanter; and the other, C, ends in the fascia lata.

Biceps flexor cruris. The muscle consists of two heads, long and short.

The long head, G, is spindle-shaped, and arises from the lower part of the ischial tuberosity in common with the semitendinosus. The short head, H, which is flattened, takes origin from the linea aspera, and from nearly the whole of the outer condyloid line of the femur, as well as from the external intermuscular septum. Both heads blend below in a tendon, which is divided into two pieces by the external lateral ligament of the knee-joint, and is inserted mainly into the head of the fibula, but a small part is prolonged to the head of the tibia: from the tendon a process is continued to the fascia of the leg.

Uncovered by muscle except above, where the gluteus maximus conceals it, the biceps lies on the adductor magnus, and crosses the great sciatic nerve. To its inner side is the semitendinosus, J. In the lower fourth of the thigh it bounds externally the hollow of the ham, and forms the outer hamstring. Between the external lateral ligament of the knee-joint and the tendon of insertion a synovial bursa intervenes.

When the tibia is free to move the muscle combines with the other hamstrings in drawing backwards that bone and flexing the knee; and after the joint has been bent it will rotate outwards the foot. If the bones of the leg are fixed, it will assist its fellow in propping the pelvis on the femur; and if the lower limb is movable at the hip, but immovable at the knee-joint, the muscle will bring down and back the raised femur, thus checking flexion of the hip, and will help in putting back the leg in the process of walking backwards.

The *semitendinosus*, J, is named from its long tapering tendon near the knee. It arises from the ischial tuberosity and the tendon of the biceps. Its fibres form at first a flat muscle; but this becomes round below, and ends at the lower third of the thigh in a tendon, which is inserted into the inner side of the tibia close below the gracilis (Plate XLVII.).

Like the other hamstrings, it is covered above by the gluteus maxi-

mus, and it rests on the semimembranosus. To its outer side is the biceps as far as the popliteal space. At the insertion a synovial membrane envelops the tendon; and under the muscle at its origin is placed another bursa (Theile). A tendinous line crosses the muscle obliquely from the inner to the outer side, so as to divide it into an upper and lower part, but some of the under fibres pass over this intersecting band.

Acting from the pelvis the muscle bends the knee-joint; and it will afterwards rotate in the foot. The leg being fixed and the hip-joint free to move, the muscle balances the pelvis. It will put back the raised femur in the same way as the biceps.

The *semimembranosus*, K, is the largest of the hamstrings, and arises by a tendon from the ischial tuberosity, external to and rather above the other two muscles. From this tendon which widens and becomes thin at the inner edge, but is thickened and rounded at the outer, the fleshy fibres spring, and form below a rounded belly. Inferiorly the muscle is terminated by a second tendon, which is inserted into a groove on the inner tuberosity of the head of the tibia, and sends off the three following fibrous processes:—one backwards to join the capsule of the knee-joint; another forwards to blend with the internal lateral ligament of that joint; and a third downwards to unite with the fascia covering the popliteus muscle. At the insertion a small bursa is interposed between the tendon and the bone.

Crossing beneath the other hamstrings it is hollowed out above to lodge the semitendinosus. Beneath it is the abductor magnus. In the lower third of the thigh it bounds internally the ham, and projects into that hollow so as to cover the popliteal vessels. Between its lower tendon and the inner head of the gastrocnemius is a bursa, which is oftentimes enlarged and contains a thick glairy reddish fluid.

Being stronger than the semitendinosus it acts more powerfully in bending the knee-joint, and in rotating inwards the foot, supposing the tibia to be the part moved. In the standing posture the pelvis is propped by it and the other hamstrings. In attempts to flex the hip-joint, whilst the knee is kept extended, it can be used to check the elevation of the femur. In concert with its fellows it will depress and move back the femur, as in walking backwards. After the body has been bent forwards, as in stooping, the muscle will draw down and back the ischial tuberosity, and place the pelvis in the erect position.

Adductor magnus. This large fleshy muscle separates the hamstrings,

and the nerves and vessels at the back of the thigh, from the femoral vessels and the other adductor muscles. Near the attachment to the lower end of the linea aspera the femoral vessels pass from before back through an aperture in it, which is fleshy behind but tendinous in front: this hole is bounded externally by the slip, F, which is fixed for a short distance to the inner condyloid line; and internally by the strong fibres, I, coming from the ischial tuberosity, and ending in a tendon which is fixed to the inner condyle of the femur.

VESSELS OF THE BACK OF THE THIGH.

Many branches of the profunda artery pierce the adductor magnus, and ramify in the hamstrings. Below that muscle lie the popliteal vessels and their branches. And in the region of the buttock some small branches of the sciatic, pudic, and internal circumflex arteries are delineated.

ARTERIES.

- a. Inferior hæmorrhoidal of the pudic.
- b. Small sciatic.
- c. Internal circumflex.
- d. First perforating branch.
- e. Second perforating.
- f. Third perforating.
- g. Muscular branches of profunda.

- i. Popliteal artery.
- j. Muscular branch of popliteal.
- k. Upper external articular branch.
- l. Upper internal articular.
- n. Inner sural branch.
- r. Outer sural branch.

VEINS.

- o. Popliteal vein.
- p. Short saphenous.

Branches of the internal iliac. The two branches here seen have been previously referred to with the description of other Plates:—*a*, marks the *inferior hæmorrhoidal* branch of the pudic, which supplies the sphincter ani and the gut (Plate XXIX.); and, *b*, points out the ramifications of the *small sciatic artery* at the lower border of the gluteus maximus (Plate XLIX.).

Branches of the profunda. Most of the branches of the profunda, viz., perforating and muscular, are directed to the back of the thigh through the adductor magnus, and ramify in the hamstrings: one (internal circumflex) runs above the adductor.

Internal circumflex, c. The transverse branch of this artery passes between the edges of the quadratus femoris, D, and adductor magnus, I, and supplies the hamstring muscles (p. 149).

The *perforating arteries* are four in number, and are derived from the profunda on the front of the thigh (p. 132). All of them pierce the adductor magnus near its attachment to the femur,—the first appearing near the top of the muscle, and the last near the lower end of the linea aspera; and all, except the first, are more or less concealed by the biceps. The first is marked with *d*, the second with *e*, and the cutaneous part of the third with *f*: they have the following distribution:—

They (except the first) are directed outwards close to the linea aspera, and through the short head of the biceps and the external intermuscular septum to the vastus externus and internus muscles, in which they are distributed, maintaining communications with their fellows and with the descending branches of the external circumflex artery. In the first artery, *d*, of the set there is a difference in its course, for it is higher than the short head of the biceps, and pierces the gluteus maximus. In its passage each furnishes a branch to the long head of the biceps, except the fourth when it is small; and as each artery pierces the short head of the biceps it gives a small offset to that muscle.

A *cutaneous branch* is given off from each of the three first; and this enters the fat along the line of the outer intermuscular septum.

Muscular or anastomotic branches of the profunda. These are distinct from the perforating arteries (p. 132), and pierce the adductor magnus internal to those vessels. Generally four in number, most of them are concealed by the inner hamstrings, but the two which are visible in the Figure are marked with *g*.

The highest is placed outside the line of the others and appears about five inches from the ischial tuberosity: it supplies the semitendinosus and biceps, and anastomoses with the internal circumflex. The remaining three come out in a line through a cleft between the fibres of the adductor, and about two inches from each other: they end mostly in the semimembranosus, but one or more may give offsets also to the biceps and semitendinosus, as is the case with the lowest in this Plate. Offsets are furnished from them to the great sciatic nerve.

These vessels serve the purpose of maintaining at the back of the thigh communications with each other in the hamstring muscles, and with branches of the popliteal artery.

Near the inner border of the adductor magnus some small *cutaneous branches* issue from the muscular fibres to end in the integuments.

The *popliteal artery*, *i*, continues the femoral trunk from the front

of the thigh to the back of the knee, and is represented in the upper limb by the lower part of the brachial artery. Named from its position in the popliteal space, it extends from the opening in the adductor magnus to the lower border of the popliteus muscle, where it divides into two—anterior and posterior tibial arteries. As its connections in the lower part of the thigh differ greatly from those in the leg, it may be divided into two parts for the purposes of description.

The upper and longer part, *i*, reaches to the knee-joint, and is contained in the popliteal space. It is placed deeply in the upper part of the ham, but it becomes more superficial below in consequence of the projection backwards of the femur, and the decreasing thickness of the limb. Its direction is oblique from the inner side of the femur to the middle of the joint. At first it is overlapped by the semimembranosus, *K*, as far as the condyles of the femur, but thence to the joint it is covered by the teguments, the fascia lata, the fat, and by veins and nerves. Beneath the vessel, from above down, are placed the lower end of the femur, and the posterior ligament of the knee-joint. Above the condyles of the femur the artery is nearer the inner than the outer side of the space; and beyond that point it lies between, and close to the heads of the gastrocnemius, *L* and *N*, with the plantaris.

The popliteal vein, *o*, is closely united to the artery throughout, but it changes its position in the following way:—as far as the condyles of the femur the vein is superficial and external, so as to leave only a narrow arterial strip visible internally, but onwards to the joint the vein covers the artery. Over the artery between the heads of the gastrocnemius lies the short saphenous vein, with cutaneous and muscular branches of arteries, veins, and nerves.

Two nerves accompany the artery, viz., the internal popliteal and the obturator. The popliteal trunk passes vertically along the middle of the limb, from the upper to the lower point of the ham, and lies external to, and much more superficial than the bloodvessels; but between the condyles of the femur it is brought much nearer to the vessels, and lower down, between the heads of the gastrocnemius, it is placed over the artery and vein. Some of the branches of this large trunk come into contact with the artery:—thus the posterior articular nerve to the joint, *2*, crosses under the artery; and the short saphenous nerve, *4*, lies over the bloodvessel in the interval between the heads of the gastrocnemius.

The obturator nerve, 1, runs on the artery as far as the knee-joint, in which it ends.

From this part of the arterial trunk muscular and articular arteries are supplied, the former coming off near the top of the ham, and the latter near the knee-joint. All are so small in size as not to disturb the reparative process which would be set up in the parent trunk after a ligature has been applied to it.

Peculiarities. Very few variations in the course and condition of the artery, and in the surrounding parts are met with. Perhaps the most noteworthy change in the artery is its bifurcation into the two tibials opposite the knee-joint, instead of below that articulation.

The position of the companion vein to the artery is inconstant, at one time covering more of that bloodvessel than at another; and not very unfrequently the vein and artery change places.

Ligature. Should circumstances render ligature of the popliteal artery necessary, the spot best suited for its application would be about an inch above the condyles of the femur, where there are only small collateral branches, and where the connections are not complicated. The surface guide for the first incision will be the line of direction of the artery, and the vessels will be arrived at by cutting vertically down through the fat towards the femur. The depth of the vessel may be diminished during an operation by bending the knee so as to relax the sides of the ham. On attempting to separate the vein from the artery it should be remembered that the two are very closely united together, and that sometimes the artery is external to the vein.

Compression. Whilst the popliteal artery is contained in the inter-muscular space behind the knee, pressure can be applied to impede the current of the circulating fluid. Bending the knee too, so as to make the calf of the leg touch the back of the thigh, will compress to a certain extent the artery, and will control the circulation of the blood in it; and this kind of pressure has been employed with success in later times in the treatment of aneurism of the popliteal artery.

Branches of this part of the artery. These consist of muscular and articular, as before said.

Upper muscular branches. Three or four in number they spring from the popliteal trunk soon after it enters the ham: they supply the semi-membranosus and biceps, but most enter the former muscle; and in those

muscles they communicate with the perforating and muscular branches of the profunda.

The *articular arteries* ramify over, and in the knee-joint. They are five in number, viz. an upper and a lower pair, with a single central branch, but only the upper pair comes into this dissection.

The upper pair of articular branches leave the sides of the parent trunk, and are directed over the femur to the front of the limb. The *external, k*, passes beneath the biceps, and the *internal, l*, beneath the adductor magnus and the other muscles bounding internally the ham; on the fore part of the knee they end in muscular branches to the triceps, and in anastomotic branches over the joint.

The *middle* or *azygos* artery penetrates into the joint through the posterior ligament; it is concealed by the large popliteal nerve.

The *popliteal vein, o*, has the same extent, and the same connections with surrounding parts as the artery, but its position to that vessel changes. Between the heads of the gastrocnemius it conceals entirely the artery, but higher up the artery becomes more and more uncovered, and at the opening in the adductor magnus the vein is quite external.

Its contributing branches are muscular and articular, corresponding with those of the artery, and it receives in addition the short saphenous vein, *p*, opposite the back of the joint.

NERVES OF THE BACK OF THE THIGH.

The great sciatic nerve and its two primary popliteal branches are continued along the back of the thigh to the leg. At the buttock the ramifications of the small sciatic nerve come into sight.

- | | |
|---------------------------------------|----------------------------------|
| 1. Obturator nerve. | 10. Muscular branch to the ham- |
| 2. Posterior articular of the knee. | strings. |
| 3. External articular of the knee. | 11. Great sciatic nerve. |
| 4. Short saphenous. | 12. Internal popliteal trunk. |
| 5. Branches to the gastrocnemius. | 13. External popliteal trunk. |
| 6. Branch to the soleus muscle. | 14. Small sciatic nerve. |
| 7. Peroneal communicating branch. | 15. Inferior hæmorrhoidal nerve. |
| 8. Nerve to short head of the biceps. | 16. Inferior pudendal nerve. |
| 9. Branch to adductor magnus. | |
| † A second branch to the adduc- | |
| tor. | |

of the *gluteus maximus* are visible, but most of the limb-branches have been cut through near their beginning.

DESCRIPTION OF PLATE LIII.

THE cutaneous vessels and nerves, and the superficial muscle of the back of the leg, are represented in this Illustration.

The skin is to be reflected by means of a median longitudinal incision along the back of the leg, from four inches above the knee-joint to the sole of the foot, with a transverse cut at each end of it. In the fat which then appears the superficial nerves and vessels may be found in the situations pointed out in the Figure; though the short saphenous nerve does not come through the deep fascia till half way along the leg.

CUTANEOUS NERVES OF THE BACK OF THE LEG.

The tegumentary nerve-branches on the back of the leg are derived from the popliteal trunks, and from the small sciatic and anterior crural nerves.

- | | |
|---|---|
| 1. Inner branch of the internal cutaneous of the thigh. | 5. Peroneal communicating branch. |
| 2. Internal or long saphenous. | 6. Cutaneous branch of the outer part of the leg. |
| 3. Small sciatic. | 7. Internal popliteal nerve. |
| 4. External or short saphenous. | 8. External popliteal nerve. |

Internal cutaneous of the thigh. The inner branch of this nerve, 1, becomes cutaneous close above the knee-joint, and descending over the inner belly of the *gastrocnemius*, reaches about half way to the heel. Near the knee it is joined by a small branch from the internal saphenous.

Internal or long saphenous nerve, 2, escapes from beneath the *sartorius* on the inside of the knee; piercing then the deep fascia, it enters the subcutaneous fatty layer, and accompanies the vein of the same name to



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the inner side of the foot. A small communicating branch unites it and the internal cutaneous.

The *small sciatic nerve*, 3, passing through the ham, pierces the deep fascia below that space. When cutaneous, it is applied to the short saphenous vein, and sending offsets around the vessel, is continued to the middle, or the lower third of the leg. Inferiorly it unites with an offset of the short saphenous nerve.

The *external or short saphenous nerve*, 4, coming from the internal popliteal trunk (p. 165), courses along the back of the leg and below the outer ankle, with the vein of the same name, to the outer side of the foot and little toe. In this course it lies beneath the deep fascia till about half way down the leg, where it enters the fat, and is joined by the peroneal communicating branch, 5. It distributes offsets to the integuments of the leg below the calf, and many branches of large size to the outer side of the heel and foot.

The *peroneal communicating branch*, 5, is derived from the external popliteal nerve: appearing superficial to the fascia, it joins the short saphenous as soon as this becomes cutaneous. To the outer side of the leg it furnishes a considerable cutaneous branch, 6, which reaches two-thirds or more of the distance to the heel: this branch may arise separately from the external popliteal trunk.

One or two other cutaneous nerves for the upper and outer part of the leg are supplied by the external popliteal nerve.

SUPERFICIAL VESSELS OF THE BACK OF THE LEG.

Both cutaneous arteries and veins are found with the cutaneous nerves at the back of the leg.

ARTERIES.

- a. Trunk of the popliteal.
- b. Muscular branch of popliteal.
- c. Cutaneous branch with short saphenous nerve.
- d. Cutaneous branch with peroneal communicating nerve.
- e. Cutaneous part of the anastomotic artery.

VEINS.

- g. Trunk of the popliteal.
- h. Internal or long saphenous.
- i. External or short saphenous.
- j. Communicating branch between saphenous veins.
- k. Communicating to saphenous from posterior tibial.

Cutaneous arteries. Many of these perforate the deep fascia at intervals, and some pierce the gastrocnemius; but the longest and largest accompany the superficial veins.

The *branch, c*, with the *short saphenous nerve* springs from the popliteal trunk near the knee-joint, and accompanies the vein beneath the fascia to reach the integuments.

The *branch, d*, with the *peroneal communicating nerve* begins in a muscular branch of the popliteal trunk, and runs with an offset of the nerve to the integuments of the outer part of the calf.

A *branch* with the *small sciatic nerve* is supplied from the muscular artery, *b*, and reaches the integuments below the upper third of the leg.

The *cutaneous branch, e*, of the *anastomotic* appears at the knee; it escapes from beneath the sartorius, and is continued onwards with the internal saphenous nerve.

Superficial veins. Two in number, and named saphenous, they begin on the dorsum of the foot—one on the outer, and the other on the inner side.

The *internal saphenous, h*, the larger of the two, appears only for a short distance on the inner side of the knee and calf of the leg. Upwards it is prolonged to the thigh, and downwards it is continued to the foot with the nerve of the same name. At the knee it is joined by branches from the deep veins.

The *external or short saphenous, i*, begins on the outer side of the foot in the venous arch on the dorsum (Plate LVIII.). Bending below the outer ankle, it ascends in the teguments along the outer border of the tendo Achillis, and the middle line of the calf of the leg to the popliteal space, where it ends by joining the popliteal vein. In the lower half of the leg it lies with the short saphenous nerve, and in the upper half with the small sciatic nerve. About the foot and heel it receives many branches both superficial and deep; higher in the leg it is joined by branches from the teguments and deeper parts, and communicates with the internal saphenous vein—one of the last set of branches being marked with *j*.

MUSCLES OF THE BACK OF THE LEG.

The superficial layer of muscles, forming the projection of the calf, is delineated in this and the following Plate. In the Illustration a view of the undisturbed condition of the popliteal space is also obtained.

A. Biceps cruris.	G. Plantaris, belly of the muscle.
B. Semimembranosus.	H. Outer head of gastrocnemius.
C. Semitendinosus.	I. Tendon of the plantaris.
D. Sartorius.	J. Soleus muscle.
F. Inner head of the gastrocnemius.	K. Tendo Achillis.

Popliteal space. In this Figure the intermuscular hollow is represented as it appears in form and size before the lateral boundaries are disturbed. In Plate LI. the space is shown as it is usually described.

As now seen the ham measures about three inches in length, and one and a half in width at the widest part; and its diminished size is due to the approximation of the biceps, A, and semimembranosus, B, over the hollow. Like the axilla, the space extends largely under the muscles, though it has but a comparatively small surface opening; and it is prolonged upwards between the femur and the hamstrings. Tumors in the space, projecting under the muscles bounding laterally the ham, would not be recognized with facility in consequence of the fleshy coverings over them.

Vessels. In the undisturbed state of the ham the popliteal vessels are laid bare only for a very short distance. About an inch of the *popliteal artery*, *a*, is visible—the part opposite the condyle of the femur, which comes from beneath the semimembranosus, and disappears under the inner head of the gastrocnemius.

A muscular branch, *b*, leaves the trunk of the artery here, and supplies the biceps and semimembranosus: this furnishes a cutaneous offset with the small sciatic nerve.

About two inches of the *popliteal vein* can be seen lying external to and in contact with the artery: at this spot the short saphenous vein opens into it.

Nerves. Very unequal parts of the popliteal nerves appear in the hollow of the ham before the muscles are drawn apart from each other.

About three inches of the internal popliteal trunk is uncovered; but strictly speaking only an inch of the external popliteal, for the greater part of the nerve here delineated lies out of the ham, and rests on the gastrocnemius and soleus muscles.

Muscles of the calf of the leg. Three muscles form the calf of the leg, viz., gastrocnemius, soleus, and plantaris, but only the first is illustrated in this Figure.

The *gastrocnemius*, the most superficial of the muscles of the calf, consists of two halves or bellies, F and H, which unite below in a common tendon.

The inner half of the muscle is attached above by tendon to the posterior part of the inner condyle of the femur, and by fleshy fibres to the condyloid line for about an inch. And the outer belly is fixed also by tendon to the outer condyle of the femur, viz. to the upper and hinder part, but chiefly to an impression on the outer surface. Fleshy fibres soon succeed to each tendon of attachment, and descend, forming separate bellies (inner and outer), to end in the wide common tendon.

The common tendon, broad and thin above, where it receives the gastrocnemius, becomes narrower below, and joins that of the soleus in the tendo Achillis, K: from it a slender piece is prolonged upwards between the halves of the muscle.

The muscle is in contact by one surface with the fascia of the leg; and by the other with the soleus and plantaris, and the popliteal vessels and the internal popliteal nerve. The inner half or belly is more prominent than the outer, and reaches lower down the leg. At its origin the two parts of the muscle limit laterally the popliteal space.

In extension of the ankle the muscle is always combined with the soleus through the tendo Achillis; but from its attachment to the femur it possesses a power of moving that bone, which is not shared by the soleus. Supposing the foot fixed, the gastrocnemius can draw back and down the femur, bending the knee-joint at the same time, as is exemplified in stooping to the ground, or in squatting. In walking backwards it will assist the soleus, the knee-joint being kept straight by the extensors, in bringing the limb over the projected foot.



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DESCRIPTION OF PLATE LIV.

THE soleus and plantaris muscles, and the lower part of the popliteal vessels and nerves, are laid bare in this view.

On cutting through the heads of the gastrocnemius opposite the knee-joint, and removing that muscle as far as the common tendon, the subjacent muscles, vessels, and nerves, will be displayed as soon as the fat and areolar tissue have been removed.

MUSCLES OF THE CALF OF THE LEG.

The deeper muscles of the calf, viz., the soleus and plantaris, cover the bones of the leg; and above these, at the back of the knee-joint, lies the popliteus—one of the deep layer of muscles.

A. Biceps cruris.	G. Plantaris.
B. Semimembranosus.	H. Outer head of gastrocnemius.
C. Semitendinosus.	I. Popliteus.
D. Sartorius.	J. Soleus.
F. Inner head of gastrocnemius.	K. Tendo Achillis.

The *plantaris*, G, possesses a short rounded belly, from three to four inches long, and a narrow, slender tendon, the longest in the body. The muscle arises by fleshy fibres from the outer condyloid ridge of the femur, above the attachment of the outer head of the gastrocnemius. Opposite the upper edge of the soleus the fibres end in the tendon, which is prolonged between the gastrocnemius and soleus and along the tendo Achillis, to be inserted into the back of the os calcis at the inner side of, or with that tendon.

At its origin the muscle appears inside the external head of the gastrocnemius, and forms part of the outer boundary of the popliteal space. As far as half way down the leg it is covered by the gastrocnemius; but where this muscle ends in a tendon the plantaris becomes cutaneous, and then lies along the inner border of the tendo Achillis.

Its action though slight is similar to that of the gastrocnemius, for if the foot is unsupported it will extend the ankle; or, the foot being fixed, it will help to bend the knee, as in stooping.

The *soleus*, J, the deepest muscle of the calf, is named from its flattened and widened form. It is attached to both bones of the leg, viz., to the head and upper third (sometimes half) of the posterior surface of the fibula, to the oblique line across the posterior surface of the tibia, as well as to the middle third of the hinder border of this bone. And between the two bones it is connected with a tendinous band, which bridges over the popliteal vessels and nerves. About midway between the knee and the heel the fleshy fibres end in a tendon, which blends with that of the gastrocnemius.

On the cutaneous surface rest the plantaris and gastrocnemius; and underneath the soleus are the deep muscles of the leg, with the main bloodvessels and nerve of the limb. The fibular attachment is thick and fleshy, and the tibial, thinner than the other, is aponeurotic on the under surface (Plate LV.). Parallel to the upper border is the popliteus muscle, I.

The *Tendo Achillis*, K, is formed by the union of the aponeuroses of the gastrocnemius and soleus about half way down the leg. At its upper end it measures about three inches in width, and is thin, but it gradually tapers downwards, becoming thicker and rounded near the heel; and finally it is inserted by a somewhat widened part into the lower half of the posterior surface of the os calcis. In Plate LV. a bursa is shown, separating the tendon from the upper part of the bone. Comparatively superficial throughout, it is covered only by the teguments and the deep fascia; and along the outer side, below, are placed the short saphenous vein and nerve.

In deformity of the foot with elevation of the heel, division of the tendon is needful to allow the os calcis to be put in contact with the ground. In the execution of this operation the cutting instrument is entered beneath the tendon about an inch above the heel, and on the inner side; and the tendon being put on the stretch by forcible flexion of the ankle, the knife is carried outwards through it with a sawing movement, care being taken not to divide the integuments as the last part of the tendon is cut through.

Sometimes the tendon is ruptured across in the living body by the forcible and sudden action of the fleshy fibres. When this accident hap-

pens, the broken ends are separated widely, the upper fragment being raised by the contraction of the fleshy bellies, and the lower piece being depressed by the descent of the os calcis through flexion of the ankle. With the view of approximating the ends, the heel should be raised by forced extension of the ankle, and the knee should be bent to relax the gastrocnemius; by the adoption of the position here indicated, the upper end, which is liable to the greatest displacement, may be more readily depressed towards, and retained near the lower fragment by a bandage on the leg.

Use of the gastrocnemius and soleus. These muscles raise the os calcis, and in this way extend the ankle. Should the toes rest on the ground, so as to render the foot immovable, the muscles can still raise the heel with the weight of the body, as in the different kinds of progression, or in standing on the toes.

If the lower attachment becomes the fixed point the soleus can render the leg-bones steady on the foot, and the gastrocnemius and plantaris will support the knee-joint, as in the straightened state of the limb in standing. During stooping to the ground the gastrocnemius and plantaris will assist in bending the knee; and in the act of rising from that posture the soleus brings back the bones of the leg over the astragalus.

Before the foot reaches the ground in walking backwards the muscles point the toes; and after the sole touches the ground they incline back the slanting limb over it.

LOWER PART OF THE POPLITEAL VESSELS.

The part of the popliteal vessels here referred to extends beyond the limits of the ham, and is laid bare by reflecting the gastrocnemius.

- | | |
|---|-------------------------------------|
| a. Popliteal artery. | e. Lower external articular artery. |
| b. Upper muscular branch. | f. Lower internal articular artery. |
| c. Branch to inner head of the gastrocnemius. | g. Branch to the soleus. |
| d. Branch to outer head of the gastrocnemius and the plantaris. | h. Popliteal vein. |
| | i. Internal saphenous vein. |
| | k. External saphenous vein, cut. |

Popliteal artery, a. The part of this artery which is now visible extends from the knee-joint to the lower border of the popliteus muscle,

I. Covered by the gastrocnemius (now reflected), it is crossed near the ending by the small tendon of the plantaris, and its point of splitting into the tibials is concealed by the soleus, J. Beneath it lies the popliteus, I.

Superficial and close to the artery is the popliteal vein, which gradually inclines inwards, so as to be placed altogether inside at the lower border of the popliteus.

The internal popliteal nerve, coursing along the bloodvessel, changes its position to the artery in the same manner as the vein; for opposite the back of the knee-joint it lies between the vessel and the surface, but is internal to the artery at the lower border of the popliteus.

Branches. From this part of the popliteal arise the lower muscular offsets, and the lower pair of articular arteries.

Lower muscular branches are furnished to the muscles of the calf, viz., gastrocnemius, soleus, and plantaris.

Branches to the gastrocnemius, c and d. Two in number, they are named, commonly, *sural*. The artery, *c*, enters the inner fleshy belly of the muscle; and the vessel, *d*, ramifying in the outer belly, gives a small offset to the plantaris.

Branch to the soleus b. Accompanying the nerve of the same name, it pierces the upper part of its muscle at the cutaneous aspect.

The *lower pair of articular arteries* are directed, one outwards, the other inwards, to the front of the knee-joint.

The *outer, e*, runs above the head of the fibula and beneath the external lateral ligament to the outer part of the knee, where it anastomoses with the other articular arteries over the joint.

The *inner, f*, lying at a lower level than its fellow, passes beneath the internal lateral ligament to the inner side of the articulation, and terminates like the other. A small articular nerve takes the same course.

The *popliteal vein, h*, begins by the union of the anterior and posterior tibial veins at the spot where the artery ends. Internal to the artery at first, it becomes afterwards superficial, and then external, as before said. The branches joining it in this part are companions to those of the artery.

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POPLITEAL NERVES.

These nerves and most of their branches have been illustrated in preceding Plates, but some of the muscular offsets of the internal nerve may be now observed more completely after the removal of the gastrocnemius.

- | | |
|---|-------------------------------------|
| 1. Internal popliteal trunk. | 5. Branch to the plantaris. |
| 2. External popliteal trunk. | 6. Branch to the soleus. |
| 3. Branch to inner head of the gastrocnemius. | 7. Lower internal articular branch. |
| 4. Branch to outer head of the gastrocnemius. | 8. Short saphenous (origin). |
| | 9. Branch to the popliteus. |
| | 10. Short saphenous (lower end). |

Internal popliteal trunk, 1. The muscular branches of this nerve are furnished to the muscles of the calf and the popliteus. The nerves to the superficial muscle of the calf, viz., gastrocnemius, have been before noticed (Plate LIII.).

The *branch to the plantaris muscle, 5*, is an offset of the nerve to the outer head of the gastrocnemius; it enters the fleshy fibres of its muscle with a small twig of an artery.

The *branch to the soleus, 6*, descends beneath the gastrocnemius, and divides into pieces which penetrate the muscle near the upper attachment to the bones of the leg, and at the superficial aspect.

The *branch to the popliteus, 9*, arises opposite the knee-joint, and passes beneath the plantaris to the lower border of its muscle: at this point it bends round the edge of the popliteus, and enters the under surface.

Lower internal articular nerve, 7, which is shown at its origin in Plate LII., appears from beneath the popliteal vessels, and passes along the upper border of the popliteus muscle with the artery of the same name; it then runs beneath the internal lateral ligament to the fore part of the knee, where it pierces the capsule of the joint.

External popliteal trunk, 2. Nearly the same view of this nerve is given in this as in the preceding Plate. Inferiorly it passes beneath the peroneus longus, and divides between that muscle and the fibula into its terminal branches for the fore part of the leg, viz., recurrent articular, musculo-cutaneous, and anterior tibial.

DESCRIPTION OF PLATE LV.

THE deep muscles, vessels, and nerves of the back of the leg are exhibited in this Plate.

The dissection for this view will be prepared by reflecting the muscles of the calf, and removing the fascia and fat which then come into sight. An aponeurosis covering the central muscle is to be divided longitudinally, and to be thrown inwards and outwards with fibres of the two lateral muscles attached to it.

DEEP MUSCLES OF THE BACK OF THE LEG.

In this group there are four muscles: three are prolonged to the foot and extend the ankle as they pass by; and the fourth, crossing behind the knee, flexes this joint.

- | | |
|-----------------------------|------------------|
| A. Popliteus. | |
| B. Fibular origin | } of the soleus. |
| C. Tibial origin | |
| D. Flexor longus pollicis. | |
| E. Flexor longus digitorum. | |

- | |
|--|
| F. Tibialis posticus. |
| G. Tendo Achillis, cut. |
| H. Peroneal muscles covered by fascia. |

The *popliteus muscle*, A, intervenes between the contiguous ends of the femur and tibia, crossing behind the knee-joint. It arises within the capsule of the joint by a tendon which is fixed to the fore part of a groove on the outer condyle of the femur; and, outside the capsule, by fleshy fibres attached to the posterior ligament. The muscle is thin and fleshy, and is inserted below the head of the tibia, into an impression on the posterior surface of the bone.

A special aponeurosis covers the muscle, and separates it from other parts. Towards the surface the popliteus is concealed by the *gastrocnemius* and *plantaris*; and is crossed by the popliteal vessels and the internal popliteal nerve. Beneath it is the tibio-peroneal joint with the upper end of the tibia. Along part of the upper border run the lower internal



articular vessels and nerves; and contiguous to the lower edge is the soleus muscle. The tendon of origin within the capsule of the knee is surrounded by the synovial membrane in the same way as the biceps is incased in the shoulder-joint.

By the contraction of the muscle the tibia will be moved backwards towards the femur, producing flexion of the knee; and after the joint has been bent the popliteus can turn in the tibia, so as to give rise to rotation inwards of the foot.

The *flexor longus pollicis*, D, is the most external of the three muscles entering the foot. Placed over the fibula, it takes origin from the posterior surface of that bone below the soleus, except about an inch inferiorly; its fibres are further attached internally to an aponeurosis covering the tibialis posticus, and externally to the fascia separating it from the peronei muscles. Near the ankle the muscle ends in a tendon, which is continued to the foot through a separate compartment in the annular ligament, and along a groove in the astragalus; its further course through the foot to the great toe is shown in Plate LVI.

The upper part of the muscle is covered by the soleus; and the lower, which lies outside the tendo Achillis, is in contact with the deep fascia. The muscle rests on the fibula, its length of attachment to the bone varying with that of the soleus, and it conceals in part the tibialis posticus. In its fibres are contained the peroneal vessels. By the outer border it is contiguous to the peronei muscles, only fascia intervening; and by the inner edge it touches the posterior tibial nerve for its lower two-thirds, but this connection has been destroyed by the displacement of the muscle.

With the foot hanging the first action of the muscle will be employed in bending the great toe, and the next in extending the ankle. When the foot is fixed this flexor assists the special extensors of the ankle in walking, and the flexor longus digitorum in standing on the toes.

If the lower end of the muscle becomes the fixed point, the fibula, when placed in front of the astragalus, will be brought backwards to a right angle with the foot, as is seen in rising from a stooping posture, and in walking backwards.

The *flexor longus digitorum*, E, lies on the tibia, and is the most slender of the muscles in the deep layer at the back of the leg. It arises from the posterior surface of the tibia, beginning at the attachment of the soleus, and extending to three inches from the lower end; and some fibres are connected externally to the aponeurosis covering the tibialis. Near

the ankle the muscle ends in a tendon, which passes behind that of the tibialis through a separate sheath in the annular ligament, and entering the foot ends in slips for the four outer toes (Plate LVI.).

In the leg this flexor is placed beneath the soleus for half its length, but the rest of the muscle projects inside the tendo Achillis and supports the tibial vessels. By the under surface it touches the tibia as far as to three inches from the inner malleolus, where it is separated from that bone by the intervention of the tibialis posticus. Along the outer edge lie the tibial vessels for about the upper half of its length, but below that point it projects outwards beyond the vessels.

The foot being movable the long flexor will bend the four outer toes, and extend afterwards the ankle. If the foot rests on the ground, so that the toes are rendered immovable, the muscle will be united in its action with the preceding flexor to raise the weight of the body, as in standing on the toes, or in walking.

Supposing the tibia placed in front of the astragalus, as in stooping, the muscle acting from below will assist in bringing that bone to a right angle with the foot.

The *tibialis posticus*, F, is the central muscle of the deep layer, and covers the membrane between the bones. It has a wide origin from the interosseous membrane, the tibia, and the fibula;—viz., from all the membrane except an inch below; from a special surface on each bone, which is contiguous to the membrane, and reaches down as far as two inches from the malleolus; and some fleshy fibres are also attached to the aponeurosis covering the surface. Inferiorly the muscle passes between the tibia and the flexor longus digitorum; and its tendon is transmitted to the foot through the inner space of the annular ligament, lying in the groove in the inner malleolus. Its insertion into the scaphoid and other bones of the foot appears in Plate LVII., Fig. 2.

Situate between the flexors of the digits, the tibialis is covered by the thin aponeurosis which is fixed into the leg-bones, and superficial to all is the soleus: on it lie the tibial vessels and nerve for the upper half. Beneath it is the interosseous membrane. Superiorly there is an interval between its attachments to the bones, through which the anterior tibial vessels pass; and inferiorly the muscle is directed inwards beneath the flexor longus digitorum.

Should the foot be free to be moved the tibialis posticus will draw it down and back so as to extend the ankle, and will direct inwards the

great toe. If the foot rests on the ground, the muscle uniting in its action with the tibialis anticus will raise the inner edge, as in standing on the outer border of the foot.

When the bones of the leg slant forwards, as in stooping, the muscle taking its fixed point below will combine with the deep flexors of the digits in bringing back the tibia over the astragalus, as the leg is straightened.

DEEP VESSELS OF THE BACK OF THE LEG.

At the back of the leg, as on the front of the forearm, the main artery of the limb bifurcates just beyond the joint, and from the chief of the two pieces into which it splits is given a third artery, so that in each member there exists one leading vessel where there is a single bone, and three where there are two bones.

ARTERIES.

- a. Popliteal trunk.
- b. Lower and external articular.
- c. Lower internal articular.
- d. Anterior tibial trunk.
- e. Peroneal trunk.
- f. Continuation of peroneal.
- g. Posterior tibial trunk.

VEINS.

- k. Popliteal trunk.
- l. Peroneal venæ comites.
- n. Venæ comites, posterior tibial.
- o. Communicating from deep to superficial veins.
- p. Internal saphenous.

The *anterior tibial artery*, *d*, is one of the two trunks into which the popliteal splits at the lower border of the popliteus muscle; it passes above the interosseous membrane to the front of the leg, and its anatomy is illustrated in Plate LVIII.

The *posterior tibial artery*, *g*, the other trunk obtained from the division of the popliteal, extends to the sole of the foot, and ends in the plantar arteries. It is limited by the lower border of the popliteus in one direction, and by the lower edge of the internal annular ligament in the other. On the surface of the limb its position would be indicated by a line from the centre of the knee-joint to a point midway between the heel and the ankle. The upper half of the vessel lies deeply, and the lower is comparatively superficial.

Upper half. Placed beneath the soleus, as is seen in the preceding Plate, it rests on the tibialis posticus, F. Close to it internally is the

flexor longus digitorum, and lying outside it near the termination is the flexor longus pollicis.

Companion veins course along the sides of the artery, and join across it at short distance.

The large posterior tibial nerve lies close to the artery: at the upper end it is internal, but it becomes external to that vessel below the origin of the peroneal artery; and it keeps afterwards the same position.

Lower half. Below the middle of the leg the soleus ends in a tendon, and the artery, gradually inclining inwards, comes to lie between the tendon and the edge of the tibia. Here it is covered by the deep fascia and teguments, and lies on the flexor longus digitorum and the end of the tibia: on its outer side is placed the flexor longus pollicis as in the upper part.

The venæ comites and the posterior tibial nerve have the same position to the lower as to the upper half.

Between the heel and the ankle the artery passes under the internal annular ligament, and over the ankle-joint; and it divides at the lower border of that band into the two plantar arteries. Internal to it at this spot lies the tendon of the long flexor of the toes, and external and nearer to it, the tendon of the long flexor of the great toe. The companion veins and nerve have the same position as above.

Size and position of the branches. Numerous small branches, chiefly muscular, arise at intervals along the artery; but about one inch and a half from the beginning springs the large peroneal trunk, and near the ankle-joint a branch of intermediate size (communicating) leaves it.

Ligature of the artery. In the living body the artery is not likely to need tying except in the case of a wound of the leg or foot, and reference will be afterwards made to those injuries; but the placing a ligature on the vessel in the dead body may be practised in both the upper or deep, and the lower or superficial part.

In the upper half. Where the posterior tibial is covered by the soleus it may be reached in the following way:—A longitudinal incision about four inches long is to be carried through the integuments and deep fascia at the distance of an inch behind the edge of the tibia:* this cut should

* If the cut is made near the edge of the tibia, with the view of separating this muscle from the bone, as is sometimes recommended, the student is apt to detach also the deep flexor of the toes, and to experience some difficulty in finding the interval between the muscles.

lie behind the internal saphenous vein, and near the edge of the gastrocnemius (Plate LIII.). Should this last muscle come into sight it is to be turned aside, and the soleus, which then appears, is to be cut through for the whole length of the superficial incision; whilst this step is being executed the ankle is to be extended with the view of relaxing the muscle, and as the fleshy fibres are divided an aponeurosis on the under surface shows itself. On carefully cutting through this aponeurotic part, and a thin piece of the deep fascia under it, the bloodvessels will be arrived at immediately beneath, though external to the line of the incision.

To find the artery, look for the posterior tibial nerve, which lies on the outer side of, and may be taken as the deep guide to the vessel.

Only a very thin sheath incloses the vessels; and in opening and detaching it care should be taken of the *venæ comites*.

In passing the ligature let the aneurism needle be moved from right to left, and without including the veins.

Occasionally no artery may be met with, for it may be wanting in this part of the leg.

In the lower half. Where the posterior tibial is uncovered by muscle the surface line before given will serve as the superficial guide to its position. A cut about two inches and a half long is to divide the teguments in that line: some branches of the internal saphenous vein and nerve will probably be cut through in this stage, but the knife should be used far enough back to be clear of the trunk of the vein. Nextly the deep fascia of the limb is to be incised on a director or without, according to the skill of the operator.

Beneath the fascia the posterior tibial nerve may be recognized, and it will serve as the guide to the artery in the wound: to the inner side of the nerve lie the bloodvessels.

When opening the sheath, and passing the thread around the vessel, the same precautions are to be taken as in ligature of the artery higher up.

Wounds of the artery are more likely to happen in the lower part of the leg where the vessel is near the surface than where it is covered by the soleus muscle. If the injury has its seat in the lower half of the leg the wound may be enlarged, and two ligatures may be applied to the bloodvessels so as to arrest the flow of blood from each end. But if the artery is opened through the soleus the depth will increase greatly the difficulty of finding the bleeding vessel in the bottom of the wound. In

this case some surgeons have recommended that the wound should be enlarged, and that the vessel should be tied, as before said; but others would prefer to try the effect of pressure applied to the wound and the main vessel of the limb before undertaking so difficult an operation.

Branches of the posterior tibial. With the exception of the large peroneal artery the other branches are small in size.

Muscular branches arise from both sides of the trunk all the way along: two or three are supplied to the fibular and tibial attachments of the soleus; and the larger of these pierces the tibial part, and ramifies on the head of the tibia and the inner side of the knee-joint. The remaining offsets enter the tibialis posticus and the flexors of the digits.

Cutaneous offsets. Some small branches pierce the fascia in the lower half of the leg, and end in the teguments (Plate LIII.): one or two of this set arising near the ankle, run with the cutaneous plantar nerve, *g*, to the sole of the foot.

Nutritious of the shaft of the tibia. It is derived from one of the upper muscular branches, and pierces the fibres of the tibialis posticus to enter the canal on the posterior surface of the bone.

A *communicating branch* is directed transversely outwards across the lower end of the tibia to join with a like offset from the peroneal artery; it is concealed by the flexor longus pollicis.

The *articular branches* arise from the artery opposite the ankle-joint, and are distributed to that articulation.

The *venæ comites*, *n*, of the posterior tibial artery lie on the sides of that vessel, over which they are united by cross pieces; they have the same extent as the artery, viz., from the foot to the lower border of the popliteus. Above, they unite with the anterior tibial veins to form the popliteal vein. At the lower part of the leg they are thick and strong.

The *peroneal artery*, *e*, is the largest branch of the posterior tibial, and arises one inch and a half from the beginning of that trunk. To reach the fibula, it passes between the soleus and the tibialis posticus; and it is then continued along that bone, contained in the fibres of the flexor pollicis. Much diminished in size at the lower part of the interosseous membrane, the vessel, *f*, is continued behind the external malleolus to the outer side of the heel; here it ends in branches, of which some supply the foot, and others anastomose with offsets of the posterior tibial, and external plantar and tarsal arteries.

Two companion veins run with the artery, and the nerve to the flexor pollicis lies on it oftentimes.

Its *branches* are muscular and communicating, but they are concealed by the flexor pollicis.

Muscular branches enter the muscles with which it is in contact, viz., soleus, tibialis, and flexor pollicis; and some wind round the outside of the fibula, lying in grooves in the bone, to reach the peronei.

The *nutritive artery of the bone* is furnished by one of the muscular branches, and enters the aperture in the shaft of the fibula, after piercing the tibialis; it is smaller than the artery to the shaft of the tibia.

Communicating branches. Two in number, anterior and posterior, they serve the purpose of anastomosing with the anterior and posterior tibial arteries.

The anterior passes to the front of the leg, through an aperture in the lower part of the interosseous membrane, and is commonly named *anterior peroneal*. It is continued to the dorsum of the foot on the outer side, and some of its offsets anastomose with the external malleolar and tarsal arteries. When the anterior tibial trunk is unusually small, or is wanting on the foot, this communicating branch is proportionally augmented, taking the place of the deficient artery in the one case, and assisting the smaller trunk in supplying the foot in the other condition.

The posterior communicating lies beneath the flexor pollicis, opposite the lower end of the tibia, and unites with a similar branch of the posterior tibial (p. 182). Sometimes there is a second communicating artery lower down. If the trunk of the posterior tibial is absent in the lower part of the leg, this branch of the peroneal, much increased in size, takes the place of that bloodvessel, and enters the sole of the foot to supply the plantar arteries.

The *companion veins*, 1 (venæ comites), of the peroneal artery lie on the sides of that vessel and communicate across it; they receive branches corresponding with the offsets of the artery, and end above in the posterior tibial veins.

The *posterior tibial nerve*, 9, is a continuation of the internal popliteal trunk, and extends from the lower border of the popliteus muscle to the space between the inner malleolus and the os calcis, where it divides near or beneath the annular ligament into the two plantar nerves. Its connections with muscles are the same as those of the bloodvessel. In close contact with the artery throughout, it changes its p ith

respect to the vessel; thus, for an inch and a half it lies inside, but thence to its termination outside the artery.

Its *offsets* are chiefly supplied to the contiguous muscles, but it gives a cutaneous nerve to the sole of the foot.

The *muscular branches*, 4, 5, 6, enter the *tibialis posticus*, *flexor digitorum*, and *flexor pollicis*; they arise at intervals along the nerve, or sometimes by a common branch from the internal popliteal trunk.

A *cutaneous plantar nerve*, 7, begins above the *os calcis*, and, dividing into two or more branches, is continued beneath the fascia and the internal annular ligament, nearly to the sole of the foot; its offsets, accompanied by small arteries, pierce separately that ligament, and end in the teguments of the under part of the heel (Plate LVI.).

The *internal saphenous vein*, *p*, begins in a cutaneous venous arch on the dorsum of the foot (Plate LVIII.); it then ascends, crossing the tibia above the inner ankle, and takes afterwards a position behind the posterior edge of that bone as far as the knee, where it has been shown passing that articulation to reach the thigh (Plate XLIV.). A nerve of the same name accompanies it.

Many superficial branches enter it in this course. In the leg it communicates with the deep veins—*anterior* and *posterior tibial*, and near the knee it joins an *internal articular vein*. In the Figure, a branch, *o*, is represented uniting with the *posterior tibial veins*.

The *internal saphenous nerve*, 8, accompanies the vein of the same name to the inner side of the foot, where it ends about the middle of the tarsus, as may be seen in Plate LVIII. In the leg it furnishes many collateral cutaneous offsets, both forwards over the tibia and front of the limb, and backwards behind but near that bone.

DESCRIPTION OF PLATE LVI.

VIEWS of the first two dissections of the sole of the foot are represented in the Figures of this Plate.

FIGURE I.

In this Illustration the dissection of the first layer of muscles with the superficial vessels and nerves is displayed.

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FIG. II.



FIG. I.



1

After the removal of the skin, the cutaneous vessels and nerves are to be sought; and when the fat and the subjacent plantar fascia have been taken away, the first layer of muscles comes into sight. The digital nerves and vessels, appearing between the muscles about the middle (in length) of the foot, are next to be traced onwards to the toes.

FIRST LAYER OF MUSCLES.

Three muscles enter into this layer:—the central one is the short flexor of the toes; the muscle in a line with the great toe is the abductor pollicis; and that lying along the outer border of the foot is the abductor minimi digiti.

A. Abductor pollicis.
B. Flexor brevis digitorum.
C. Abductor minimi digiti.
E. Flexor tendon of the great toe.
H. Lumbricales.

K. Transverse ligament of the toes.
N. Flexor brevis pollicis.
O. Flexor minimi digiti.
P. Interossei of the outer space.

The *flexor brevis digitorum*, B, acts on the four outer toes; and it is called flexor perforatus from its tendons being pierced by those of the long flexor. The muscle has a narrow origin posteriorly from the inner side of the large tubercle at the back of the os calcis, and from the investing plantar fascia. About the middle of the foot it is divided into four fleshy parts, the outer being very small; and from each part proceeds a tendon to the root of the toe, where it enters a fibrous sheath with a slip of the long flexor (Fig. ii.). Lastly, in the sheath the tendon of the short flexor, I (Fig. ii.), is pierced opposite the metatarsal phalanx, as in the finger, for the passage of the tendon of the other muscle, J; and it is then inserted by two parts into the sides of the middle phalanx.

The muscle is incased in a sheath of the plantar fascia, of which a piece has been shown on the surface. Along the outer side lies the abductor of the little toe, and along the inner, the abductor of the great toe. The parts covered by it are delineated in Fig. ii., viz. the tendons of the long flexors with the accessory muscles, and the plantar vessels and nerves. Its tendons decrease in size from the inner to the outer side; and that to the little toe may be very small and not pierced, or it may be even absent: near the toes they are crossed by the digital nerves.

When this flexor contracts it will move the middle phalanges of the four outer toes towards the sole, bending the first phalangeal joint, as in the fingers.

The *abductor pollicis*, A, the most internal muscle of the first layer, takes origin behind by a wide attachment to the inner part of the larger tubercle of the os calcis; to the lower border of the internal annular ligament; to the inner side of the tarsus (its ligamentous structures) as far forwards as the scaphoid bone; and to the plantar fascia, though not so largely as the other two muscles. Anteriorly it ends in a tendon, and is inserted into the inner side of the base of the metatarsal phalanx of the great toe, in union with the inner head of the short flexor.

Contained in a sheath of the plantar fascia, it is separated behind from the short flexor of the toes by an intermuscular partition, and in front by the internal plantar vessels and nerve which issue between the two. In Fig. ii. the parts covered by it may be perceived, viz. the long flexor tendons, the accessory muscle, and the internal plantar vessels and nerve.

As the name expresses the muscle will abduct slightly the great toe from the others; but as it lies almost parallel with the digit moved, it will be employed mainly in assisting the short flexor to bend the metatarsophalangeal joint.

The *abductor minimi digiti*, C, is wide behind, like the abductor pollicis, and arises more largely from the os calcis, viz. from the fore part of the inner or larger tubercle, and from the outer tubercle; and many fibres are attached to the plantar fascia both superficially and on the outer side. In front the muscle is inserted by tendon into the outer side of the metatarsal phalanx of the little toe.

Like the two preceding muscles it is invested by the fascia. Internal to it behind is the short flexor of the toes, with an intermuscular septum of fascia intervening; and about the middle of the foot the offsets of the plantar vessels and nerves separate them. When the muscle is everted, as in Fig. ii., it will be seen to rest on the flexor accessorius, F, the peroneus longus, and the short flexor of the little toe, O.

The muscle can abduct the little toe from its fellows, and bend the first joint of that toe after the same manner as the abductor pollicis.

Superficial transverse ligament of the toes, K. In the form of a flattened band it reaches from the outer to the inner toe, and consists of transverse fibres which are united to the sheaths of the flexor tendons.

Under it pass the digital vessels and nerves. It serves the purpose of uniting together the roots of the digits, as in the hand. A deeper transverse ligament connects the heads of the metatarsal bones.

SUPERFICIAL ARTERIES OF THE SOLE.

Near the roots of the toes appear the digital arteries, which spring from the plantar trunks; and over the muscles ramify cutaneous vessels of the posterior tibial and plantar arteries.

- | | |
|---|---|
| <p>a. Cutaneous branch of the sole.</p> <p>b. Internal plantar trunk.</p> <p>c. External plantar trunk.</p> <p>d. Digital branch of outside of little toe.</p> <p>e. Digital branch of inside of great toe.</p> | <p>f. Digital branch of first and second toes.</p> <p>g. Digital branch of second and third toes.</p> <p>h. Digital branch of third and fourth toes.</p> <p>i. Digital branch of fourth and fifth toes.</p> |
|---|---|

Cutaneous arteries. The teguments of the posterior part of the sole receive branches from the posterior tibial trunk, and those of the rest of the foot are supplied by the plantar arteries.

The *cutaneous plantar* of the posterior tibial, *a*, is shown at its origin in Plate LV: when it is small there may be two instead of one. Piercing the internal annular ligament as one or two branches, which accompany the cutaneous nerve, it ramifies in the teguments of the under and fore part of the heel. Its *venæ comites* join the posterior tibial veins.

Cutaneous branches of the plantar arteries issue by the sides of the flexor brevis digitorum—between it and the abductor pollicis internally, and between it and the abductor minimi digiti externally; and towards the toes the cutaneous offsets are furnished by the digital arteries:—These several branches supply the integuments anterior to the distribution of the artery, *a*.

The *plantar arteries*, the chief vessels of the sole of the foot, are two in number, inner and outer; they are derived from the splitting of the posterior tibial at the lower border of the internal annular ligament; and their connection with muscles at the hinder part of the foot can be observed in Fig. ii.

The *internal plantar*, *b*, is directed beneath the abductor pollicis (the

that muscle and the flexor digitorum; and after it becomes superficial it furnishes the digital branches.

The *digital branches*, four in number, are named first, second, and so forth, from the inner to the outer border of the foot. At first they are covered by the plantar fascia, but near the root of the toes they issue between the processes of that fascia, though the first or most internal enters the teguments farther back than the rest. Each, except the first, bifurcates to supply the contiguous sides of two toes. On the digits they are continued along the lateral aspect, as in the hand; and distributing in their course cutaneous and articular offsets, end on the last phalanx in a tuft of fine nerves from which the ball of the digit is principally supplied.

The first digital nerve, 4, courses to the inner side of the great toe, and sends many cutaneous branches to the inside of the foot anterior to the tarsus: an offset from it enters the flexor brevis pollicis.

The second digital, 5, supplies the most internal lumbricalis muscle, and ends on the sides of the second and third toes.

The third digital, 6, belongs to the neighboring sides of the third and fourth toes, and gives a branch to the second lumbricalis muscle.

The fourth digital, 7, is distributed, like the others, to the collateral sides of the third and fourth toes, and is joined by a communicating branch, 8, from the external plantar.

The internal plantar nerve in the foot resembles the median in the hand in its supply to three digits and a half; in the arrangement of its digital branches; and in having a communication with the nerve furnished to the remaining digits. Like the median it gives branches also to the first two lumbricales, and the abductor and flexor brevis pollicis.

But as the muscles of the first digit are not alike in the hand and foot the distribution of the two nerves is not identical throughout. For instance in the foot there is not any branch corresponding with that given by the median to the opponens pollicis; and none in the hand answering to the nerve of the flexor perforatus in the foot. Lastly, the whole of the flexor brevis pollicis is supplied by the internal plantar nerve in the foot, but only the outer head of the muscle in the hand receives a branch from the median.

The *external plantar nerve*, 3, is chiefly expended in muscles, and emits digital branches only to one toe and a half, like the ulnar nerve in the hand.

It begins inside the heel with the internal plantar (Fig. ii.), and is directed outwards across the foot towards the back of the fourth interosseous space, where it sends off digital branches, and then sinks into the sole of the foot with the external plantar artery to end in deep muscles: its termination may be ascertained in Plate LVII. In this course the nerve lies at first under the abductor pollicis, nextly between the flexor brevis digitorum and flexor accessorius, and lastly in the intermuscular space between the flexor of the digits and the abductor minimi digiti. It is accompanied by the external plantar artery and venæ comites, but the nerve is not always situate on the same side.

From this part of the nerve branches are sent to the abductor of the little toe, and the flexor accessorius: these are visible in Fig. ii.

The *digital branches*, two in number, run forwards beneath the plantar fascia, and become subcutaneous near the toes, between the digital processes of that fascia: but the most external nerve pierces the fascia farther back than the other. One of the two (internal) splits at the front of the fourth interosseous space, like the branches of the other plantar nerve, to end in the adjacent borders of the fourth and fifth toes; but the other remains undivided on the outer side of the little toe. As these branches are continued along the toes they have the same arrangement as the digital branches of the internal plantar nerve.

The branch for the outer side of the little toe, 10, gives many cutaneous offsets to the anterior half of the outer border of the foot: it may supply also the contiguous muscles, viz., the flexor minimi digiti, O, and the interossei of the fourth space.

The branch, 9, which ramifies in the collateral sides of the fifth and fourth toes, communicates by means of the branch, 8, with the internal plantar, but does not supply any muscle.

FIGURE II.

The second layer of muscles of the foot, and the trunks of the plantar vessels and nerves may be studied with this Figure.

To obtain this view the first layer of muscles is to be cut through near the heel, and is to be removed in part, as is here shown. Then the dissection will be completed after the removal of the fat and fascia.

SECOND LAYER OF MUSCLES.

In this group are included the flexors of the digits which take origin at the back of the leg, viz., flexor longus pollicis, and flexor longus digitorum with its accessory muscles. The same letters in the two Figures mark the same parts.

D. Flexor longus digitorum.	J. Tendon of flexor longus digitorum.
E. Flexor longus pollicis.	L. Sheath of flexor tendons.
F. Flexor accessorius.	N. Flexor brevis pollicis.
G. Inner head of accessorius.	O. Flexor minimi digiti.
H. Lumbricales.	P. Interossei.
I. Tendon of flexor brevis digitorum.	Q. Tendon of peroneus longus.

Tendon of flexor longus pollicis, E. Issuing at the back of the foot from a groove in the astragalus and os calcis, where it is enveloped by a synovial membrane, it is directed inwards to the root of the great toe; it then enters the digital sheath, where it is incased in a second synovial sac, and is inserted into the base of the ungual phalanx.

In the foot it rests on the flexor brevis pollicis, N, and lies under the tendon of the flexor longus digitorum, D: to this last tendon it is connected by a slip, which is prolonged most commonly into those pieces of the common flexor of the digits belonging to the second and third toes, and in greatest proportion to the inner one (Turner).*

Tendon of flexor longus digitorum, D. This tendon appears on the inner part of the foot; it is then inclined towards the middle of the sole, and divides into four pieces for the four outer toes. Each of these pieces, J, enters the digital sheath with a tendon, I, of the short flexor, and having pierced that tendon is inserted into the base of the last phalanx.

As the tendon escapes from the internal annular ligament it lies internal to the flexor pollicis, and is surrounded by a synovial membrane as far as the place of junction with it of the accessorius muscle, F; and as it crosses over the tendon of the flexor of the great toe a communication

* On Variability in Human Structure, by William Turner, M.B.; Trans. of Royal Soc. of Edinb., vol. xxiv.

is established between the two, as before said. Finally from the pieces into which the tendon splits a group of four accessory muscles—the lumbricales—takes origin. The parts covered by the tendon are set forth in Fig. i. of the following Plate.

Sheaths of the flexor tendons. Along the four outer toes the pieces of the short and long flexor are lodged in a partly osseous and partly membranous canal, as in the fingers. Towards the plantar surface the sheath is formed by fibrous bands, L, which are strongest opposite the centre of the two nearest phalanges, and thinnest opposite the joints; whilst at the opposite aspect it is constructed by the bones which are hollowed out to be adapted to the tendons. A synovial membrane lubricates the sheath, as in the fingers, and reaches posteriorly along the tendons nearly to the attachment of the lumbricales. In the sheath accessory bands are connected with the tendons; and these are similar to, but not so well marked as those in the hand (vol. i., p. 80). In the sheath of the great toe only one tendon is contained.

Action of the flexors on the toes. In both members the bending of the digits takes place in the same order. Firstly the hinder phalangeal joint is flexed by the short flexor carrying down the middle phalanx. Nextly the anterior joint is bent by the long flexor drawing the last phalanx towards the sole. And lastly the metatarso-phalangeal joint is flexed by the indirect action of the two tendons bound to the first phalanx by the sheath of the digit, and by the direct contraction of the lumbricalis and interossei muscles.

The *musculus accessorius*, F, is a squarish fleshy mass, which has received its name from assisting the long flexor to bend the digits. It is bifurcated behind, and arises externally by tendon from the outer surface of the os calcis and the long plantar ligament, and internally by a thick fleshy part, G, from the inner concave surface of that bone. About the middle of the sole it becomes tendinous, and ends most commonly by joining the flexor perforans and the slip of the flexor pollicis, so as to assist in forming the tendons for the second, third, and fourth digits.*

On the muscle rest the external plantar nerve and vessels, and the flexor perforatus; and under it lie the os calcis and the long plantar ligament. Between the heads of origin of the muscle a piece of the plantar ligament appears.

* Professor Turner in the Paper (Trans. of the Roy. Soc. of Edinb.) before referred to.

Supposing the long flexor to act alone the four outer toes would be bent somewhat under each other; but when the accessorius contracts it opposes that oblique inward movement of the digits, and with the help of the flexor perforatus bends the toes directly back.

Lumbricales, H. Four in number, they serve as accessory flexor muscles to the four outer toes; and are named, first, second, etc., from the inner to the outer side of the foot. They take origin behind from the pieces into which the flexor perforans splits, the most internal being fixed commonly to only one, and each of the others to two tendinous slips. Near the metatarso-phalangeal articulation each ends in a tendon, which passes at the tibial side of the toe to join the extensor tendon on the dorsum of the first phalanx: as they bend down by the sides of the joints they are closely attached to the metatarsal phalanx, or are connected with it by a thin tendinous slip.

The muscles decrease in size from the first to the fourth. At the root of the toes they become cutaneous between the processes of the plantar fascia, with the digital nerves and arteries, and they appear there even before the removal of the superficial flexor muscle (Fig. i.).

Contracting with the long flexor these muscles bring towards the sole the metatarsal phalanges, thus serving as flexors of the metatarso-phalangeal joints of the four outer toes.

Plantar arteries. In the second Figure the course of these vessels between the first two strata of muscles may be observed. Of the two the external is the largest, and furnishes most digital branches to the toes; but a more complete view of these arteries will be contained in the next Plate. In this Figure the small muscular branches of the internal plantar artery to the inner two lumbricales, and to part of the flexor brevis pollicis are displayed.

Plantar nerves. Two in number like the arteries, there is not the same disparity in size between them, for though one supplies most digits, the other gives most offsets to muscles. They are placed with the blood-vessels between the first two muscular strata. The distribution of the internal nerve to three digits and a half and a few muscles has been given at p. 189; and the arrangement of the external nerve, which is furnished to one digit and a half and many muscles, will be afterwards considered.

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FIG. II.



FIG. I.



DESCRIPTION OF PLATE LVII.

IN this Plate the last two stages of the dissection of the foot are delineated.

FIGURE I.

Part of the external plantar vessels and nerve, with their branches, and the short muscles of the great and the little toe are represented in this Figure.

After making the preparation of the parts illustrated in Figure II. of the foregoing Plate, the dissection of the third stage will be completed by dividing the accessorius muscle and the tendons of the flexors of the digits about two inches in front of the heel; and by removing the areolar tissue from the muscles, vessels, and nerves, after the flexor perforans with its lumbricales has been thrown forwards to the toes. Whilst the flexor tendon is being raised, the small nerves and arteries to the outer two lumbricales muscles are to be sought with care.

MUSCLES OF THE THIRD LAYER.

This stratum consists chiefly of the short muscles of the first and fifth digits, which reach scarcely farther back than the metatarsal bones: they are the short flexor and adductor of the great toe, the short flexor of the little toe, and a fourth muscle (*transversalis pedis*) which crosses the heads of the metatarsal bones.

N. Flexor brevis pollicis.
O. Flexor brevis minimi digiti.
Q. Peroneus longus.
R. Adductor pollicis.

S. Transversalis pedis.
T. Part of the tendon of the tibialis
posticus.
U. Long plantar ligament.

The *flexor brevis pollicis*, N, the most internal muscle of the set, is pointed and tendinous behind, but is split anteriorly into two pieces or heads. Its tendon is attached posteriorly to the cuboid bone, and blends

with the prolongation, T, from the tendon of the *tibialis posticus* to the outer cuneiform bone. Towards the front of the metatarsal bone it is divided into two heads, and these are inserted into the base of the first phalanx,—the inner joining the *abductor pollicis*, A, and the outer blending with the *adductor*, R.

Superficial to the muscle is the tendon of the long flexor; and underneath it lie the deep vessels of the foot. In each head of insertion a sesamoid bone is contained.

The muscle draws towards the sole the metatarsal phalanx, to which the long flexor tendon is not attached, and thus bends the metatarso-phalangeal joint of the great toe.

The *adductor pollicis*, R, arises behind from the sheath of the *peroneus longus* tendon, Q, and from the bases of the second, third, and fourth metatarsal bones. In front it joins the outer head of the *flexor brevis pollicis*, and is inserted into the outer side of the first phalanx of the great toe.

It is concealed by the *flexor perforans* and the *lumbricales*; it covers some of the *interossei*, and the external plantar vessels and nerve. United with it at the insertion is the *transversalis pedis*.

Acting with the *transversalis pedis* the muscle will adduct the great toe to the others; and in concert with the short flexor and abductor it will bend the metatarso-phalangeal joint.

Transversalis pedis, S. This is a thin fleshy slip, which lies across the heads of the metatarsal bones. It arises by bundles of fibres from the capsule of the metatarso-phalangeal articulations of the fourth, third, and second toes (sometimes the fifth); and from the fascia covering the *interossei* muscles. Internally it is inserted with the *adductor* into the nearest phalanx of the great toe.

By its cutaneous surface it is in contact with the *flexor perforans*, the *lumbricales*, and the digital nerves; and by the deep, it touches the *interossei* and the digital vessels. The muscle is described by Theile as a short head of the *adductor pollicis*.

From its position and attachment to the four inner toes it will approximate them to one another.

The *flexor brevis minimi digiti*, O, lies on the metatarsal bone of the little toe, and resembles the *interossei*. Posteriorly it arises from the base of the fifth metatarsal bone, and from the sheath of the *peroneus longus* tendon; and it is inserted anteriorly into the base of the first pha-

lanx after blending with the capsule of the metatarso-phalangeal articulation, and into the fore part of the metatarsal bone (Theile).

As the name signifies the muscle may be used as a flexor of the metatarso-phalangeal joint; but it may draw down slightly the outer border of the foot in consequence of its attachment to the metatarsal bone.

EXTERNAL PLANTAR NERVE.

As far as the root of the little toe the external plantar with its digital offsets was shown in the preceding Plate, and the remainder or the deep part of the nerve is represented in this view.

- | | |
|--|---|
| 2. Internal plantar nerve, cut.
3. External plantar nerve.
4. Superficial or digital part of external plantar. | 5. Deep part of external plantar.
6. Branch to transversalis pedis.
†† Branches to outer two lumbricales. |
|--|---|

The *deep part* of the *external plantar nerve*, 5, is directed inwards beneath the flexor perforans and the lumbricales, and ends in branches for the adductor pollicis, R. In this course it accompanies the external plantar artery, and distributes offsets to the neighboring muscles of the third and fourth strata, which are referred to below:—

To the under surface of the adductor pollicis two or three branches (the terminal pieces of the nerve) are distributed; one is shown piercing the outer border.

A slender branch, 6, enters the transversalis pedis: in this foot it was divided into two.

For each of the outer two lumbricales there is a small branch or nerve, †, which enters the under surface with an arterial offset. Commonly these branches are destroyed as the long flexor muscle is raised.

All the interossei receive branches from the external plantar, but these are more fully illustrated in Fig. ii.

In its distribution in the foot this nerve resembles closely the ulnar nerve in the hand. Like its representative in the other member it gives many muscular and but few digital branches. Thus it supplies one digit and a half, and the teguments of that border of the foot which is in a line with the smallest digit. Like the ulnar too it furnishes branches to all the muscles of the small digit, and to the adductor of the large digit;

and in the same way as that nerve it sends offsets to the outer two lumbricales and to all the interossei.

Differences in the distribution of the two nerves are due to a want of similarity in the muscles of the first and fifth digits, and to the existence of some special muscles in each member. For instance the opponens or adductor minimi digiti is present in the hand but not in the foot, and will have a separate branch from the ulnar. The short flexor of the thumb is a less simple muscle than that of the great toe, and is supplied in part (inner head) by the ulnar; whilst the external plantar does not reach the homologous muscle in the foot.

One special muscle in the hand (*palmaris brevis*) is supplied by the ulnar; and two special muscles in the foot (*accessorius* and *transversalis pedis*) obtain their nerves from the external plantar.

The *external plantar artery, c*, crosses the sole of the foot with its nerve, to form the plantar arch. Digital and muscular branches arise from the arch: the former of these and the trunk will be delineated in Fig. ii.; and the latter, which enter the neighboring muscles, are visible in this stage.

Each of the two external lumbricales receives an arterial twig; and there is sometimes another branch for the second lumbricalis muscle, as in this dissection.

The *transversalis pedis* is supplied on the under surface by one or more of the subjacent digital arteries.

For the interossei of the three outer spaces offsets are derived from the digital arteries and the arch (Fig. ii.).

Branches to the adductor pollicis penetrate the fibres at the under surface, like the nerves.

From the most external digital artery proceed branches for the flexor brevis minimi digiti.

Veins. The companion veins of the plantar arch and its branches were purposely removed in the dissection, to render the Figure less complicated.

FIGURE II.

The fourth stage of the dissection of the foot is depicted in this Figure.

By cutting across and removing the adductor and part of the flexor

brevis pollicis the plantar arch will be laid bare; and by removing the transversalis pedis and the transverse metatarsal ligament beneath it, and passing the scalpel backwards for a short distance in the centre of the three outer intermetatarsal spaces the interossei muscles will be defined. On the removal of some areolar tissue from the hinder part of the sole, the insertion of the tibialis posticus, the tendon of the peroneus longus, some ligaments of the foot, and small deep anastomotic vessels come into sight.

MUSCLES OF THE FOURTH LAYER.

In the last layer of the sole of the foot are included the interossei, and the tendons of insertion of the tibialis posticus and peroneus longus. When the same letters are used in the Figures they point to the same parts.

M.	Prolongations of the tendon of the tibialis posticus at its insertion.		X. Three plantar interossei. Z. Four dorsal interossei.
V.			
W.			
Y.			

The *interossei muscles* are seven in number, and fill the intervals between the metatarsal bones. Two are lodged in each intermetatarsal space, except in the inner where there is only one; and they are attached to the bones bounding laterally the spaces: they are arranged into a plantar and a dorsal set.

The *plantar set*, X, three in number, are slender fleshy slips, which lie in the three outer spaces, and arise each from a single metatarsal bone, viz., fifth, fourth, and third. Opposite the metatarso-phalangeal joint each becomes tendinous, and is inserted into the inner side of the base of the first phalanx of its toe; a slip is prolonged from it to join the extensor tendons on the dorsum of the phalanx.

The *dorsal set*, Z, are four in number, one being placed in each of the intermetatarsal spaces. Each has a double origin laterally from the two metatarsal bones between which it is lodged. Anteriorly they end in tendons, which are inserted, like the plantar muscles, into the fibular side of the fourth and third toes, and into both sides of the second toe: they join also the extensor tendons on the dorsum.

All the muscles are visible in the sole of the foot, where they are

covered by fascia, by the external plantar nerve, and the plantar arch and its branches: near the toes the transversalis pedis and the transverse metatarsal ligament lie on them. On the dorsum of the foot only the dorsal set appear; and they are pierced behind by arteries passing from the one aspect of the foot to the other.

The chief office of these muscles is to approximate the four outer toes towards, or to remove them from the great toe; and they act therefore as abductors and adductors of those digits to the inner one. For instance the three plantar and the innermost dorsal muscle adduct the four smaller to the larger toe; and the remaining three muscles of the dorsal set will move the second, third, and fourth toes away from that digit, so as to become abductors.

When the four outer toes are being bent by the action of the flexors the interossei will help in the completion of the movement; and when the digits have been extended these muscles will serve to fix the first phalanges against the metatarsal bones.

Tendon of the peroneus longus, Q. The fleshy belly of the muscle in the leg is delineated in the following Plate; and only part of the course of its tendon, and the insertion, appear in this Figure. As now seen, the tendon winds round the outer surface of the os calcis to cross the foot from the outer to the inner side. At first it is received into a groove in the cuboid bone, and is then continued forwards to be inserted into the base of the metatarsal bone of the great toe, and into the fore part of the internal cuneiform bone; sometimes also by a slip into the base of the second metatarsal bone.

As the tendon crosses the sole it is contained in a sheath which is formed towards the outer part by the long plantar ligament, U, and the cuboid bone, and at the inner part by areolar tissue; and its motion in the sheath is facilitated by a synovial sac which extends to the insertion. On the outer aspect of the cuboid bone the tendon becomes flattened and thickened, and at that spot it contains either fibro-cartilage or a sesamoid bone.

Insertion of the tibialis posticus, T. Arising at the back of the leg (Plate LV.) its tendon passes along the inner side of the foot, supporting the articulation between the astragalus and scaphoid bone, and is inserted into the tubercle on the inner and under part of the os scaphoides. From the insertion processes are continued to several of the tarsal and metatarsal bones:—one, V, reaches the internal cuneiform; another, Y,

is attached to the middle cuneiform and the second metatarsal; a third, W, is prolonged to the external cuneiform, the cuboid, and the third and fourth metatarsal bones; and a fourth, M, is reflected backwards to be fixed into the os calcis. In short, the tendon is attached to all the tarsal bones except the astragalus; and to the metatarsal bones with the exception of those of the great and the little toe.

DEEP VESSELS OF THE SOLE.

Both tibial vessels end in the sole of the foot—the anterior passing through the first interosseous space, and the posterior entering at the inner side of the heel; and both furnish digital arteries to the toes.

c. External plantar trunk.	h. Digital branch of third and fourth toes.
d. Digital branch of outside of little toe.	i. Digital branch of fourth and fifth toes.
e. Digital branch of inside of great toe.	l. Dorsal artery of the foot.
f. Digital branch of first and second toe.	n. Artery of the great toe.
g. Digital branch of second and third toes.	o. Communicating branch to deep arch.

The *plantar arch* is the curved terminal part of the external plantar artery, c. Its extent is limited by the base of the little toe in one direction, and the back of the first interosseous space in the other. Internally it joins the dorsal artery of the foot (anterior tibial) by means of the communicating branch, o, so as to establish a direct inosculation between the main vessels on the fore and hinder aspects of the leg. In this course it crosses three of the metatarsal bones near their tarsal ends, and rests on most of the interossei muscles. At the outer part it is covered by the flexor perforans and the lumbricales, and at the inner, by the adductor pollicis.

Companion veins lie on its sides, and the external plantar nerve curves in a similar way just behind it.

From the convexity or anterior part of the arch proceed digital arteries, and from the concavity arise perforating and small nutritive branches.

The *digital branches*, four in number, are furnished to the three outer toes and half the second. Each, except the most external, splits at the

cleft of the toes to supply the contiguous sides of two; and at the point of division springs a small branch (*anterior perforating*), which passes downwards to anastomose with the interosseous arteries on the dorsum of the foot. Whilst they lie on the interossei small offsets are emitted to those muscles.

The first branch, *d*, lying on the outside of the small toe, remains single to the end of the digit, and supplies cutaneous branches to the outer part of the foot, like the nerve.

The second, *i*, placed over the fourth interosseous space may communicate with the former by a cross piece (Plate LVII.); it gives an offset to the fourth lumbricalis, and branches for the sides of the fifth and fourth digits.

The third corresponds with the third space, and furnishes offsets to the third lumbricalis and the transversalis pedis: its two terminal pieces belong to the sides of the fourth and third toes.

The fourth may supply the second lumbricalis; and it ends on the sides of the third and second digits.

On the toes the arteries are continued to the extremity, one on each side; and they unite in an arch on the plantar surface of the last phalanx, from which fine branches are sent to the tip of the digit. At the extremity of the second toe the branch derived from the plantar arch anastomoses with the digital branch, *f*, of the dorsal artery of the foot. Whilst the arteries lie on the sides of the digits they furnish superficial offsets forwards and backwards, and communicate beneath the flexor tendons by means of cross branches behind the interphalangeal articulations, as in the fingers.

Three *posterior perforating branches*, *s*, pass down from the arch between the lateral attachments of the dorsal interossei muscles of the outer three spaces, and anastomose with the interosseous arteries on the dorsum of the foot.

Some small *nutritive* and *muscular* branches take their origin from the arch, and from the digital arteries.

The external plantar artery of the foot answers to the ulnar artery of the hand; it resembles that vessel in furnishing digital branches to three toes and a half, and in forming an arch which communicates internally with the other leading vessel of the limb.

But the following marked differences exist in the mode of ending of the two main bloodvessels of the limbs. In the foot there is but one arch in which both tibials are united; and the plantar arch thus formed has a

deep position in the sole of the foot, where it lies in contact with the interossei. In the hand on the contrary there are two distinct palmar arches—superficial and deep, which communicate through the intervention of small branches: of these, the former is continuous with the ulnar artery, and the latter with the radial.

On comparing also the muscular offsets of the arterial trunks in the hand and foot considerable dissimilarity will be found, as in the nerves, on account of the want of uniformity in the muscles of the two parts.

Wounds of the plantar arch can take place but seldom in consequence of the vessel being protected by the shoe, and the depth of the soft parts. If it was opened it would bleed freely, as in injury of the palmar arch, from its free inosculation with the anterior tibial artery.

With bleeding from a wound in the foot, such as would lead to the supposition that the arch itself, or one or more of the digital arteries close to their origin from it had been opened, the flow of blood would generally be arrested by pressure applied to the anterior tibial artery on the dorsum of the tarsus, to the posterior tibial between the heel and ankle, and to the wound in the foot by a graduated compress, as in the case of wounds of the palm of the hand. Should considerable recurrent bleeding still take place, ligature of one or both of the tibials may be tried, to cut off the free supply of blood to the foot.

Dorsal artery of the foot, l. This artery is a continuation of the anterior tibial trunk (Plate LVIII.), and furnishes digital branches to one toe and a half. It enters the sole at the back of the first interosseous space, and ends by joining the plantar arch through the *communicating* part, *o*. From its extremity in the sole of the foot the large artery of the great toe is sent forwards, and one or two small branches run backwards.

The *large artery of the toe, n* (art. mag. pol.), is the digital branch of the anterior tibial, and supplies one toe and a half: it has the following arrangement. It runs forwards over the first interosseous muscle to the cleft of the toes, where it splits into the two collateral branches for the great toe and the next; and near the fore part of the interosseous space a branch is directed inwards under the flexor muscles, or between the heads of the short flexor, to form the digital branch, *e*, of the inner side of the great toe.

The anterior tibial artery in the foot resembles the radial artery in the hand in supplying branches to one digit and a half. But it differs from

that vessel in assisting to complete the plantar arch instead of forming, like the radial, a separate arch.

Deep anastomosis of the foot. In the sole of the foot amongst the processes of the tendons and the ligaments is situate a chain of anastomoses between branches of the internal and external plantar with the dorsal artery of the foot, as is shown in the Drawing.

External plantar nerve, 3. In this dissection of the nerve the branches to the interossei are traced out. From the part of the nerve by the side of the plantar arch small muscular offsets are supplied to all the interossei muscles: these are so evident as not to require figures of reference. The remaining muscular branches of this part of the nerve have been described with Fig. i.

DESCRIPTION OF PLATE LVIII.

THE dissection of the front of the leg and dorsum of the foot appears in this Illustration.

In preparing the dissection divide the skin along the centre of the limb, and reflect it to the sides by means of a cross cut at each end, and a third opposite the ankle. After search has been made for the cutaneous nerves and vessels in the fat, the fascia may be taken away to show the muscles and the deeper vessels and nerves; but in executing this step the two parts of the anterior annular ligament are to be defined and left, as in the Plate.

CUTANEOUS VEINS AND ARTERIES.

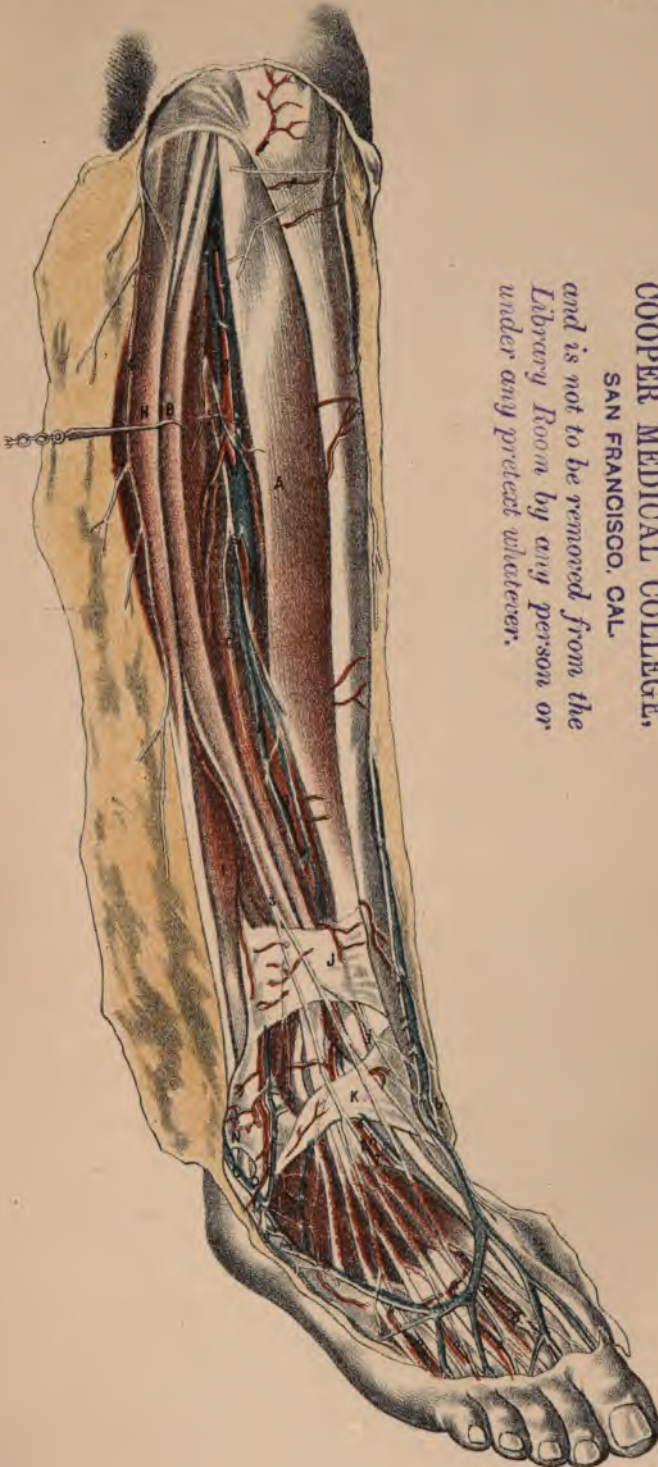
On the dorsum of the foot is the arch in which the saphenous veins begin. The small arteries ramifying on the surface of the leg and foot are derived from the anterior tibial trunk.

- a. Venous arch of the foot.
- b. Internal saphenous.
- c. External saphenous.

- d. Communicating veins.
- p. Venæ comites.

The *venous arch*, a, on the dorsum of the foot, answers to a similar arch on the back of the hand. Contained in the subcutaneous fat, it is

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placed anterior to the tarsus. Its convexity is turned towards the toes, and is joined by small digital veins; and at its concavity open small superficial, with some deep veins, *d*. At each end the arch is continued into a saphenous vein.

The *internal saphenous vein*, *b*, begins at the inner end of the dorsal arch, and ascending to the leg in front of the inner ankle crosses obliquely the tibia: its further course in the leg behind that bone is manifest in Plate LV.

The *external saphenous vein*, *c*, springs from the confluence of the outer end of the arch with a vein from the outer side of the foot: it soon bends below the outer ankle to the back of the leg, where it is represented in Plate LIII.

Cutaneous arteries. In the leg these are small in size, and are offsets of the anterior tibial, but as they are unnamed no letters of reference have been placed on them. They issue mostly along the borders of the tibialis anticus, and those along the outer side of the muscle mark the position of the subjacent tibial trunk. One larger than the rest, and external to them, pierces the fascia outside the extensor of the toes, *B*, and runs with the musculo-cutaneous nerve, *3*.

On the dorsum of the foot and toes the other small unnamed arteries originate in the dorsal artery of the foot and its branches.

CUTANEOUS NERVES OF THE FRONT OF THE LEG.

On the dorsum of the foot, as on the back of the hand, there is a free distribution of cutaneous nerves; whilst the teguments on the fore-part of the leg, like those on the back of the forearm, are but sparingly supplied with nerves.

1. Internal saphenous.
2. External saphenous.
3. Musculo-cutaneous.

4. Cutaneous of external popliteal.
5. Cutaneous of anterior tibial.

The *internal saphenous*, *1*, courses along the inner side of the leg (Plate LV.), and sends forwards many fine branches to the teguments over the tibialis anticus: the largest of these, near the knee, is marked thus, †. Below the middle of the leg it turns to the fore part of the ankle with the saphenous vein to end in the teguments of the inner side

of the instep, reaching about two-thirds along the foot. Near the ending it is joined by the musculo-cutaneous; and some of the terminal filaments sink through the fascia, like the musculo-cutaneous nerve in the forearm, to supply the tarsus.

The *external saphenous*, 2, a branch of the internal popliteal trunk (p. 165), descends along the back of the leg to the heel (Plate LIII.). Bending forwards below the external malleolus, it runs along the outer border of the foot, and terminates on the outside of the little toe. When in contact with the foot it furnishes nerves to all the outer margin, but the offsets to the sole are larger than those on the dorsum. Oftentimes the nerve is large; then it supplies more digits than usual, and a larger part of the dorsum of the foot.

The *musculo-cutaneous nerve*, 3, is one of the terminal pieces of the external popliteal trunk (p. 175), and takes partly a deep and partly a superficial position in the limb, so as to give branches to muscles and integuments—whence the name. Beginning at the back of the limb, it is directed forwards at first outside the fibula and under the peroneus longus. In front of that bone it is inclined down between the peronei muscles and the extensor longus digitorum; and gradually reaching the surface, it pierces the fascia in the lower third of the leg to end on the dorsum of the foot and toes.

When the nerve is beneath the fascia it furnishes offsets to the peroneus longus and brevis muscles.

After it becomes cutaneous it divides into two pieces, inner and outer, which are continued over the dorsum of the foot to the extremities of the toes, like the radial nerve on the hand. These two branches may vary much in size and in distribution; but commonly they supply dorsal digital nerves to all the toes, except the outer side of the little toe, and the contiguous sides of the great and second toes. Each of the two primary pieces furnishes offsets to its sides of the foot, and communicates with the saphenous nerve close to it.

Anterior tibial nerve, 8. At the back of the first interosseous space this nerve becomes cutaneous; and it ends in two dorsal digital nerves for the adjacent sides of the first and second toes. Offsets of it enter the teguments of the first interosseous space; and it is joined by the musculo-cutaneous nerve.

Cutaneous of the external popliteal, 4. Arising from the external popliteal at the back of the limb, and piercing the fascia, it is distributed

in the integuments of the fore and outer parts of the leg as low as the spot at which the musculo-cutaneous makes its appearance.

MUSCLES OF THE FRONT OF THE LEG.

Two groups of muscles come into view in this Illustration: an anterior which bends the ankle and extends the toes; and a lateral for the extension of the ankle.

A. Tibiali anticus.	I. Peroneus brevis.
B. Extensor longus digitorum.	J. Upper part of annular ligament.
C. Extensor longus pollicis.	K. Lower part of annular ligament.
D. Peroneus tertius.	N. External annular ligament.
F. Extensor brevis digitorum.	O. Sheaths for the peronei.
H. Peroneus longus.	

Anterior group of muscles. Between the tibia and fibula are lodged two flexors of the ankle (tibialis and peroneus tertius); and between them are situate the long extensor of the toes and the special extensor of the great toe. On the dorsum of the foot lies the short extensor of the toes.

The *tibialis anticus*, A, is the widest and most internal muscle of the group. Its origin is fixed to the upper half or rather more of the outer surface of the tibia, and to the contiguous part of the interosseous membrane—the membranous attachment reaching rather lower down than the osseous. In the lower third of the leg the muscle acquires a tendon, and passing through a sheath in each part of the annular ligament, is inserted into the inner surface of the internal cuneiform bone, and the base of the metatarsal bone of the great toe.

In contact with the fascia throughout, the muscle is inseparably united with it by an aponeurosis at the upper part. It rests on the tibia and the interosseus membrane, covering the spine of that bone in the lower third of the leg; and lies over the ankle-joint and the tarsus. Its outer border touches the extensor digitorum and extensor pollicis, and is the guide to the anterior tibial vessels. In the annular ligament the tendon is surrounded by a synovial sac which reaches nearly to the insertion.

With the foot free to be moved the muscle will bend the ankle and carry inwards the great toe; it can also raise the inner border of the foot, drawing inwards this part. The foot being fixed, as in standing, it will

help the *tibialis posticus* to lift the inner margin of the instep, so as to make the outside of the foot the supporting part of the body.

After the advanced foot has reached the ground in walking, the muscle will be able to bring the tibia forwards over the instep; and in stooping and rising it will assist in steadying the bones of the leg.

In deformity of the foot with inversion, and elevation of the inner part of the sole from the ground, the tendon of the *tibialis anticus* is shortened and prominent, and will have to be divided, together with others, before the sole can be brought into its natural position.

The *peroneus tertius*, D, is small, and is generally united with the *extensor longus digitorum*. It arises from the lower fourth or third of the inner surface (anterior part) of the fibula, below the long extensor of the toes, and from the lower end of the interosseous membrane. The tendon varies much in size, like the fleshy part of the muscle, and is transmitted through a sheath in the lower part of the annular ligament with the long extensor, to be inserted by a widened extremity into the upper part of the base of the fifth metatarsal bone.

More or less joined with the long extensor of the toes, it is superficial throughout, and is separated from the *peroneus brevis* behind it by a piece of fascia which is fixed into the fibula. Underneath the muscle lie the lower portion of the fibula, the ankle-joint, and the short extensor of the toes.

When the foot hangs the muscle will be employed as a flexor of the ankle, like the *tibialis*; and it will raise the outer border of the foot. But should the limb be fixed by contact with the ground, the action of the *peroneus tertius* on the leg in walking and stooping will be the same as that of the *tibialis*.

The *extensor longus digitorum*, B, is a thin narrow muscle, which arises from the head and three-fourths of the inner surface (anterior part) of the fibula; from the external tuberosity of the tibia, and the contiguous interosseous membrane (about an inch); and from the fascia of the leg. Its tendon below is contained in a sheath in the lower portion of the annular ligament with the *peroneus tertius*, and divides into four pieces for insertion into the four outer toes.

On the back of the toes the tendons are arranged like those of the extensor of the fingers. For example, on the first phalanx there is a fibrous expansion, which is not fixed into the subjacent bone, and is formed by pieces of the long and short extensors, and by tendons from the *lumbricalis*

and interossei; but that on the little toe does not receive any contribution from the short extensor. At the front of the metatarsal phalanx the expansion divides into three parts, which are connected with the two remaining phalanges in this manner:—The short central piece is inserted into the base of the middle phalanx; and the two lateral blend into one at the fore part of the middle, and are inserted into the base of the last phalanx. Opposite the two nearest phalangeal joints a fibrous slip descends on each side from the expansion, to blend with the capsule of those articulations.

The muscle lies partly in the leg and partly on the dorsum of the foot: and although not fixed into the nearest phalanx, it is so closely united to that bone by the other tendinous slips joining it, as to be able to extend the metatarso-phalangeal joint. Like the tibialis it is superficial throughout. Along the inner side lie the tibialis and extensor pollicis with the tibial vessels and nerve; and on the outer are situate the two external peronei, but separated by a process of fascia.

If the foot and toes are not fixed the muscle extends the phalangeal joints from root to tip, separating the digits at the same time; and it raises afterwards the foot so as to bend the ankle.

Should the foot rest on the ground with the fibula slanting backwards, that bone can be brought forwards over the foot by this muscle. In stooping and rising it will assist the tibialis.

The *extensor brevis digitorum*, F, occupies the dorsum of the foot, and gives tendons to the four inner toes. Thin and fleshy behind, it arises from the outer surface of the os calcis near the fore part, and from the outer end of the lower piece of the anterior annular ligament. At the back of the metatarsal bone it divides into four fleshy bundles; and from these proceed tendons to join the common expansion on the dorsum of the first phalanx in the case of three toes, but the tendon of the great toe is inserted separately into the base of the nearest phalanx.

On the instep the muscle is covered by the long extensor and the peroneus tertius; and the inner fleshy belly, larger than the others, is detached from the rest of the muscle for a considerable distance. The tendons blend with those of the long extensor, and are applied to the outer border.

It assists the long extensor in straightening the toes, and directs them somewhat out at the same time.

The *extensor proprius pollicis*, C, is concealed for the most part by the preceding muscle. It takes origin from the middle three-fifths of the inner surface (anterior part) of the fibula, and from the interosseous mem-

brane. At the ankle it ends in a tendon, which is contained in a space in the lower piece of the annular ligament, and is thence directed over the inner part of the foot to be inserted into the base of the last phalanx of the great toe.

The part of the muscle in the leg is deeply placed between the extensor longus digitorum and the tibialis; but the tendon on the dorsum of the foot is superficial. The tibial vessels lie inside the extensor as low as the ankle, but afterwards outside it.

As this muscle passes over the ankle, like the extensor of the digits, it has a similar action, viz. first straightening its digit and next bending the ankle. And the slanting limb touching the ground, the extensor of the great toe will help to move the fibula over the foot: or to support that bone in stooping.

The *anterior annular ligament* of the leg is constructed by the deep fascia strengthened by transverse fibres near the ankle-joint. It incases and binds down the tendons of the muscles, and consists of two parts—upper and lower.

The upper piece, J, is placed above the ankle, and is squarer in form than the lower. It is attached laterally to the tibia and fibula, and is continued into the fascia of the leg by the upper and lower edges. In it is one sheath towards the inner side for the tibialis anticus, and this is lined by a synovial sac, which is prolonged on the tendon into the other part of the ligament; whilst the other muscles of the leg pass under it without being contained in sheaths. This band serves the purpose of fixing the vertical parts of the long muscles to the front of the ankle, so as to render them able to bend that joint.

The lower piece, K, is wide and thin internally but pointed and thick externally, and lies below the level of the ankle on the outer side. Externally it is fixed into the upper surface of the os calcis close to the interosseous ligament, and internally into the tibial malleolus and the plantar fascia; and it blends with the deep fascia by its edges. Three sheaths for tendons are constructed in it; an inner for the tibialis anticus, an outer for the extensor longus digitorum and peroneus tertius, and an intermediate one for the extensor proprius pollicis. A synovial sac lubricates each sheath, and the inner one is continued into the compartment in the upper piece, J, of the ligament. The use of this part is to bind horizontally the tendons of the long extensors to the foot, in order that they may act on the ankle as well as the digits.

LATERAL MUSCLES OF THE LEG.—Two muscles enter into this group; and as they are attached to the fibula they are named peronei.

The *peroneus longus*, H, the highest and most superficial of the two, arises from the outer or anterior surface of the upper half of the fibula, though gradually diminishing in width downwards; from the external border of that bone by thin fleshy fibres behind the peroneus brevis, as low as the inferior fifth; and from the fascia incasing the muscle. Its long tendon passes through an annular ligament behind the outer malleolus, and through a separate sheath of fibro-cartilage, O, on the outer side of the os calcis to reach its insertion in the sole of the foot (p. 200).

Superficial in the leg it rests on the fibula and the peroneus brevis, concealing altogether this muscle above, but only in part below. By means of the sheath attaching it to the bones the peroneus can move both the ankle-joint and the foot. In the sole of the foot it lies deeply, and is received into a third fibrous sheath (Plate LVII., Fig. 2, Q).

The muscle is able, when the foot is unsupported, to extend the ankle, and to raise the outer border of the instep, depressing at the same time the inner edge of the great toe.

The foot being immovable the peroneus longus will elevate the outer border, throwing the weight of the body on the inner side; and in rising from stooping it will help to bring back the fibula to a right angle with the foot.

The *peroneus brevis*, I, is attached to the outer or anterior surface of the fibula for the lower two-thirds of the shaft—the upper end being pointed and lying inside its fellow; and from the intermuscular septum between it and the anterior muscles of the leg. At the ankle its tendon passes with that of the peroneus longus through the external annular ligament, lying next the bone; escaped from this it is received into a sheath, O, on the outer side of the os calcis, above that for the peroneus longus; and it is finally inserted by a widened end into the base of the metatarsal bone of the little toe.

In the leg the lower part of this peroneus is superficial in front of the other, and its tendon is connected to the fibula and the tarsus by sheaths like those of its companion. Fascia isolates it from the muscles on the front and back of the leg.

This muscle extends the ankle, and moves the foot outwards almost horizontally when the toes are not supported; but when the foot is fixed, as in standing, it will assist the long peroneus in raising the outer border

from the ground. In rising from stooping it acts on the fibula like the *peroneus longus*.

External annular ligament, N. This is a thin band behind and rather below the fibular malleolus, which is formed by thickened fascia, like the other annular ligaments near the ankle. In front it is attached to the malleolus, and behind to the *os calcis*. Its upper end joins the fascia of the leg, and the lower is united by a thin fibrous layer to the bands of fibro-cartilage fixing the tendons of the *peronei* to the *os calcis*. There is but one space in the ligament, and this lodges the two *peronei*; it is lubricated by a synovial sac, which bifurcates inferiorly—a piece being continued with each tendon into the fibro-cartilaginous sheath.

ANTERIOR TIBIAL VESSELS.

The anterior tibial artery with its *venæ comites* extends through the front of the leg to the sole of the foot.

- | | |
|--|--------------------------------------|
| <i>e.</i> Cutaneous branch with a nerve. | <i>j.</i> Anterior peroneal branch. |
| <i>f.</i> Offsets of the recurrent branch. | <i>k.</i> Tarsal branch. |
| <i>g.</i> Anterior tibial trunk. | <i>l.</i> First dorsal interosseous. |
| <i>h.</i> Dorsal artery of the foot. | <i>n.</i> Metatarsal branch. |
| <i>i.</i> Internal malleolar branch. | <i>o.</i> Three outer interosseous. |

The anterior tibial artery, *g*, is derived from the splitting of the popliteal trunk at the lower edge of the *popliteus* muscle; and it reaches to the sole of the foot, which it enters through the hinder part of the first interosseous space, ending as before said (p. 203). Beginning at the back of the leg (Plate Lv.) it is directed forwards at first between the bones and above the interosseous membrane, and then along the front of the leg and the dorsum of the foot. A line on the surface of the limb from the inner part of the neck of the fibula to the first interosseous space would mark the position of the subjacent vessel. For the purpose of description a division of it into two is commonly made, viz. an upper part called anterior tibial, and a lower, which has been named the dorsal artery of the foot.

In the leg the anterior tibial is deeply placed between the fleshy bellies of the muscles; but it becomes more superficial near the ankle, and is covered finally only by the annular ligament and the teguments. To its inner side nearly all the way is the *tibialis anticus*; though close to the

lower end the extensor proprius pollicis intervenes between the two, having crossed the artery just above the ankle. On the outer side comes first the extensor longus digitorum for about two inches, then the extensor pollicis as far as the ankle, and finally the extensor longus digitorum again at the ending. It rests in the upper two-thirds of its course on the interosseous membrane, and in the lower third, on the tibia and the ankle-joint.

Companion veins, *p*, encircle the artery, forming a plexiform disposition over the upper part. The anterior tibial nerve, *6*, comes into contact with the vessels about the place of meeting of the upper and middle thirds of the leg, and runs with them to the foot; at first it is external, then internal to the vessels, and finally external in position on the dorsum of the foot.

Branches. Most of the collateral offsets are unnamed, and are distributed to the neighboring muscles and the teguments. Even the named branches are small in size, like the offsets of the arteries of the upper limb; they are the following:—

The *recurrent branch* springs from the upper end of the artery, and ascends through the tibialis to the knee-joint: it gives branches to that muscle, and its superficial ramifications are marked with *f*.

A *cutaneous branch*, *e*, accompanies the musculo-cutaneous nerve: it supplies the contiguous muscles, and ends in the teguments.

Malleolar branches. Two small arteries with this name take origin a little above the ankle, and ramify over the malleoli: the inner is shown by, *i*; and the outer, concealed by the muscles, joins the anterior communicating branch, *j*, of the peroneal artery (p. 183).

Articular branches pass from the lower end of the artery into the ankle-joint.

Peculiarities. Occasionally the trunk of the anterior tibial artery has been found superficial to the muscles in the lower part of the leg; in such a condition of the vessel a superficial wound might lay it open. Its size is very variable, like the arteries of the upper limb, and the deficient part is supplied by an offset from the posterior tibial, or from the peroneal artery.

Dorsal artery of the foot, h. This part of the anterior tibial extends from the ankle-joint to the ending in the sole of the foot. It lies near the surface; and its position will be found by the line before mentioned.

For the greater part of its extent it is covered by the inner piece of

the extensor brevis digitorum, but at the beginning and ending only by the special fascia and the teguments. It is firmly supported by the subjacent tarsal bones. Laterally it has a tendon on each side, viz. the extensor pollicis internally, and the extensor longus digitorum externally, but both are at a distance from it—about half an inch.

The venæ comites have the same arrangement here as above, and the anterior tibial nerve is placed on the outer side.

Branches. Many offsets are given to the tarsal and metatarsal portions of the foot: those leaving the inner side of the vessel are unnamed; and those on the outer side, which are rather larger, are named tarsal, metatarsal, and interosseous, from their distribution.

The *tarsal branch, k*, arises opposite the scaphoid bone, and is directed beneath the extensor brevis digitorum to the outer part of the tarsus; it gives branches to that muscle, and anastomoses with the arteries before and behind it, viz. metatarsal, *n*, and anterior communicating of the peroneal, *j*.

The *metatarsal branch, n*, leaves the trunk at the fore part of the tarsus, and runs outwards across the base of the metatarsal bones to the border of the foot, where it anastomoses with the tarsal and external plantar arteries. In its course it lies beneath the short extensor, and forms an arch, from the fore part of which the following small interosseous arteries proceed:—

The *dorsal interossei, o*, of the three outer spaces spring from the metatarsal branch, and run forwards to the cleft of the toes. Here each bifurcates, and the small resulting branches are continued to the end of the toes as the dorsal digital arteries: the most external furnishes also a branch to the outer side of the little toe. From the beginning of each interosseous branch a piece descends to the sole of the foot to unite with the plantar arch; and from the ending springs another offset to enter a digital artery: these are named anterior and posterior perforating branches (p. 202).

First dorsal interosseous branch, l, arises from the dorsal artery as it is about to sink into the sole: it is continued forwards in the first space, in the same manner as the other arteries, and divides like them for the sides of the first two toes. The space receives offsets from it.

Branch of the peroneal artery, j. The anterior communicating branch of this artery (p. 183) comes through the aperture in the lower part of the interosseous membrane, and descends in front of the outer malleolus to

the tarsus, where it distributes many branches: above it anastomoses with the external malleolar, and below with the tarsal artery.

Venæ comites. The anterior tibial veins have the same extent and connections as the artery, and end above in the popliteal trunk: in their course they receive branches corresponding with those of the artery. They have a plexiform disposition around the tibial bloodvessel, especially above; and they anastomose with the internal saphenous vein.

Peculiarities. The dorsal artery of the foot is subject to great variations in its position and size. Frequently it forms an arch under the extensor brevis digitorum, with the convexity towards the outer border of the foot. Much bleeding from a wound on the top of the instep, towards the outer part, which would be far out of the usual line of the vessel, would suggest the probability of the artery being opened in its unusual situation.

When the anterior tibial is so small as not to reach to the lower part of the leg the anterior communicating branch of the peroneal becomes the dorsal artery of the foot, and takes the place of the deficient tibial trunk: this substituted vessel may have also the same uncommon curved course on the dorsum of the foot as the anterior tibial.

Ligature. In the dead body the artery is easily reached in consequence of its superficial and fixed position; and the operation of ligature may be practised on it in the following way:—

First, the position of the vessel is to be ascertained by a line on the surface, from the centre of the ankle to the back of the first interosseous space.

A cut in that line, about two inches in length and nearer the interosseous space than the ankle-joint, is to divide the skin, the teguments, and the deep fascia covering the muscles.

After cutting through the superficial strata the inner piece of the extensor brevis digitorum comes into sight; and the tendon connected with those fleshy fibres serves as the deep guide to the bloodvessels issuing from beneath. In the bottom of the wound appears the anterior tibial nerve, which is generally outside and close to the artery; but the tendons of the long extensors of the digits are at some distance from the vessels, and are not visible.

Opening now the arterial sheath, and detaching the *venæ comites*, the thread is to be passed around, and to be knotted on the vessel in the usual way.

Should the tibial artery have the unusual course on the dorsum of the foot, which has been above cited (p. 215), no bloodvessels will be met with by the usual incision in the line of the artery; but if the cut be made to reach the interosseous space, the wandering vessel may be recognized coming to the hinder part of that interval to enter the foot.

Wound of the artery. Considerable bleeding would follow the opening of the artery on the dorsum of the foot on account of the free communication of the anterior with the posterior tibial bloodvessel. For the arrest of the hæmorrhage two plans may be adopted. According to the one, two ligatures may be applied to the vessel, one above, and the other below the opening; and according to the other, pressure may be made on the trunk of the artery, and to the wound, whilst, if necessary, the flow of blood in the posterior tibial artery may be checked by the employment of a compress to that trunk.

Lymphatics of the leg. Only a summary of these small vessels will here be given, as they are not indicated in the Figure. There are superficial and deep lymphatics with the bloodvessels, as in the upper limb.

In the superficial set are two groups, one with each saphenous vein. The lymphatics with the short saphenous enter the popliteal glands; and those with the long saphenous vein open into the inguinal glands. Enlargement and inflammation consequent on disease or irritation of the lymphatics on the opposite borders of the foot would affect different glands.

The deep lymphatics run along the main arteries, and all converge to the popliteal glands. In connection with the lymphatics on the anterior tibial artery there is a small gland; this is the lowest in the limb, and is to be found about half way down the leg.

BRANCHES OF EXTERNAL POPLITEAL NERVE.

The three terminal branches of the external popliteal nerve, viz. recurrent tibial, anterior tibial, and musculo-cutaneous, which begin between the fibula and the peroneus longus, are met with in the dissection of the front of the leg.

5. Recurrent tibial branch.
6. Anterior tibial nerve.

7. Branch to short extensor of the toes and the tarsus.
8. Cutaneous part of anterior tibial.

The *recurrent tibial branch*, 5, passes under the extensor longus digitorum, but over the tibial vessels, to the artery of the same name, and ascends through the tibialis anticus to the knee-joint.

The *anterior tibial nerve*, 6, is directed, like the preceding, beneath the long extensor of the toes, and meets with the tibial vessels above the middle of the leg. From this point it is closely applied to those vessels, crossing them once or more; and continues on the outer side of the dorsal artery of the foot till this bloodvessel enters the sole. Finally it pierces the fascia, and ends in the dorsal teguments of the great toe and the next.

This nerve furnishes offsets to all the muscles of the front of the limb below the knee. It supplies, namely, the two flexors of the ankle (tibialis anticus and peroneus tertius); the common extensors of the toes (ext. digit. longus and brevis); and the special extensor of the great toe (ext. prop. pollicis). To the tarsus it gives a large branch, 7, which resembles much in appearance the nerve distributed to the back of the wrist: from this branch offsets are distributed to the extensor brevis digitorum, which covers it, as well as to the underlying bones and articulation.

The *musculo-cutaneous nerve*, 3, takes a downward course at first between the fibula and the peroneus longus, H, and nextly, between the peroneus brevis and the extensor longus digitorum, B, to become cutaneous at the lower third of the leg. Its ending on the dorsum of the foot and the toes has been before described (p. 206).

Before the nerve pierces the deep fascia it emits branches as before said to the two lateral peroneal muscles.

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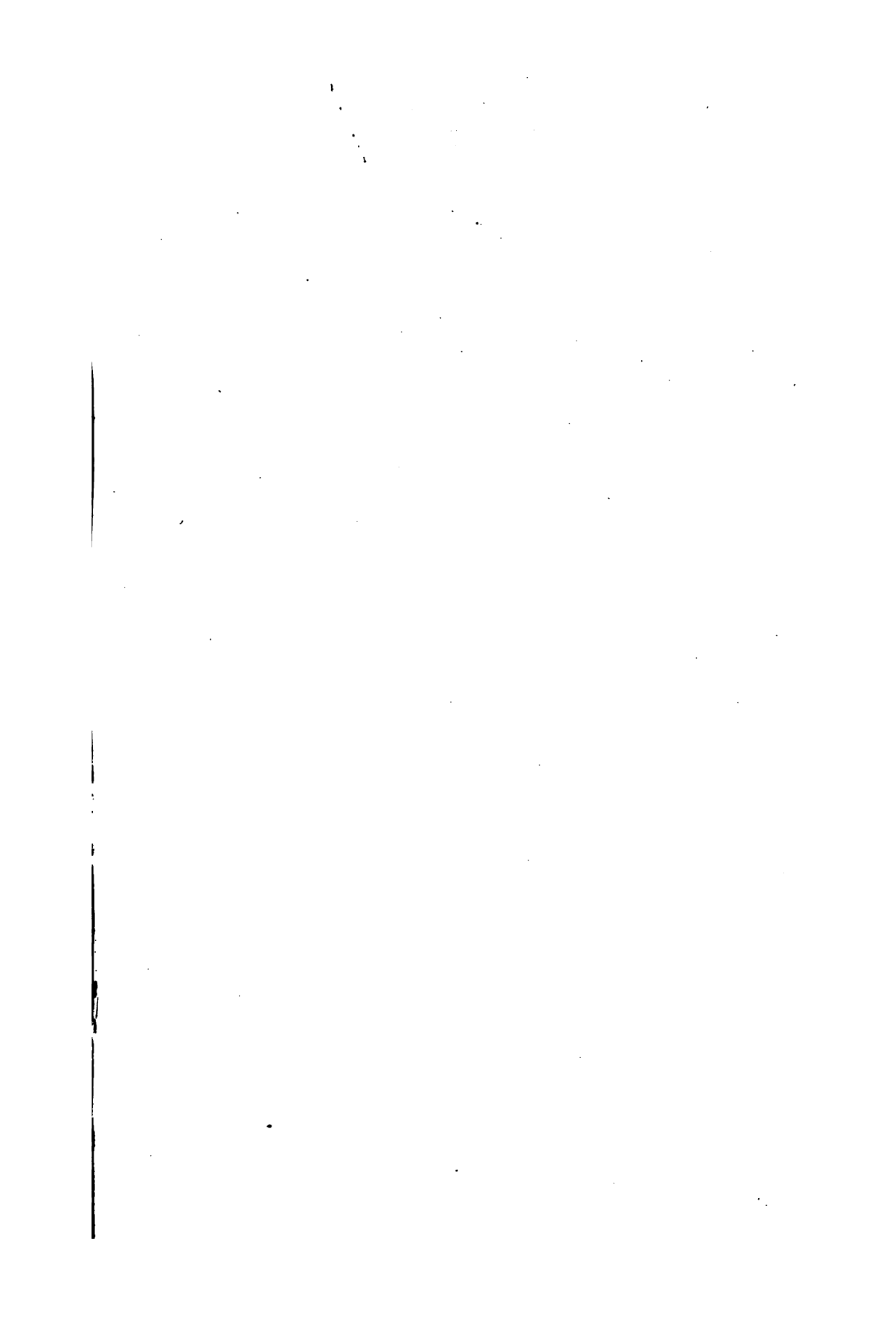
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